רשימות

לבוטניקה ולמדעי גננות

מוציא לאור: ה. ר. אופנהימר

Vol. I
1935/36
No. 3

כרך א
תרצ"ו-צ"ז
מס' 3

THE PALESTINE JOURNAL
OF BOTANY
AND HORTICULTURAL SCIENCE

EDITOR: H. R. OPPENHEIMER

REHOVOT
SOLE AGENT FOR FOREIGN COUNTRIES:
W. JUNK • DEN HAAG • SCHEVENINGSCHE WEG 74

M. Shoham's Press, Tel-Aviv Rd.

This journal is published at irregular intervals. Each volume contains about 10 — 15 sheets, consisting of 16 pages each.

It is sold abroad at **£ 0.1.0** *per sheet.*

Contents of this number:

Supplement to

PALESTINE JOURNAL OF BOTANY

REHOVOT SERIES

Vol. II No. 1

Indices to Volume I, 1935-1937,

published at Rehovot under the name of

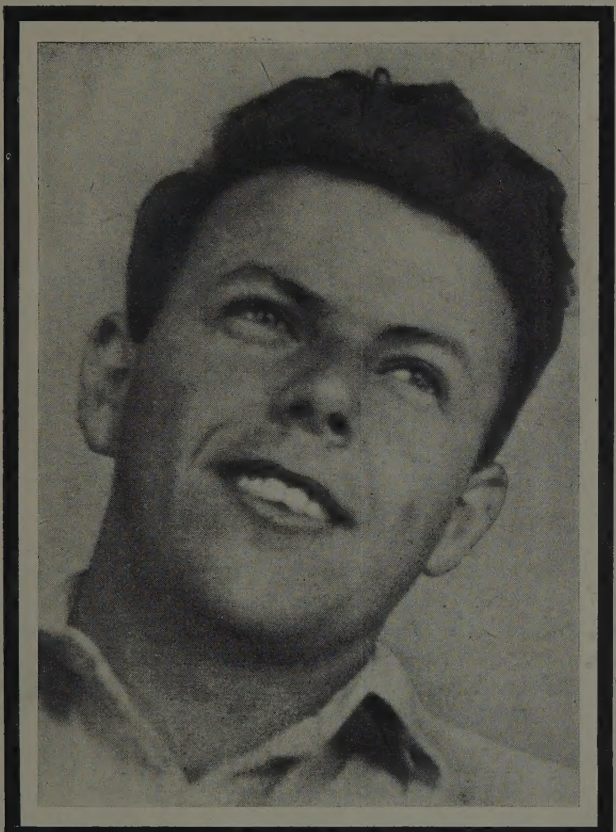
THE PALESTINE JOURNAL OF BOTANY AND HORTICULTURAL SCIENCE

By H. R. OPPENHEIMER

M. Shoham's Press, Tel Aviv, Tel. 2239

Vol. I, No. 3 1935/36

מוקדש לגרשון מושיוב ז"ל



GERSHON MOSHEJOFF
(1913 — 1936)

In memoriam G. Moshejoff

ISSUED ON APRIL 30TH, 1937.

EDITORIAL.

I.

The Heroic Death of Gershon Moshejoff

The disturbances during the summer of 1936 caused a heavy loss to our ranks. Gershon Moshejoff died on the 20th of August as a result of the wounds which he had received three days before during the defence of the colony *Kiryath Anavim.*

Moshejoff was assistant in plant physiology at the Hebrew University. At the time of his death he was only 23 years old and had not yet passed his examinations for the Master of Science degree. His death was a painful loss to the botanists of Palestine since he had aroused highest hopes. Nature had endowed Moshejoff with rare gifts of mind which were united with physical beauty, kindness, strength of character and a readiness for self sacrifice. The overwhelming sorrow which his death caused among his friends, teachers and colleagues can hardly be described as he was one of those to awaken love and admiration wherever they appear.

Personal and scientific bonds connected him very closely with his teacher Dr. Michael Evenari, who had introduced him to certain problems of developmental physiology and especially to those of growth substances, and in whose laboratory he carried out his experiments. Moshejoff left two scientific publications. The first dealt with "Growth Promoting Substances" and appeared in the Hebrew journal "Hatteva Vehaaretz". It gives a general review of the subject. Moshejoff intended originally to publish his second publication, the result of his own research, in our journal, but decided later — for reasons which can not be discussed here — to publish abroad. We wish to summarise here shortly the essential points of the findings of Moshejoff. Grains of *Triticum durum* lose their ability to form roots under the influence of a solution of

copper sulphate. It seems apparent, that this salt destroys root forming substances (as defined by JULIUS SACHS) which are possibly identical with the *Rhizokalin* of Went. MOSHEJOFF succeeded to reawaken the ability of the sprouting wheat to form roots by bathing the seeds, after the treatment with copper sulphate, in plant sap prepared from leaves of *Vitis vinifera, Solanum tuberosum, Cynodon Dactylon,* etc. or by soaking them in water, in which cuttings of *Nerium Oleander* had been allowed to root. In his publication MOSHEJOFF also discussed the physical properties of the said substances and came to the conclusion that they can not be placed in the group of auxines.

After the untimely death of DOLK the field of growth promoting substances has lost again in MOSHEJOFF a highly gifted young student. His memory will always remain in high honour among the botanists of the country.

II.

It is a special pleasure to us to congratulate Mr. MICHAEL ZOHARI for having received the degree of doctor of philosophy. He completed his studies at the German University at Prague. ZOHARI belongs to the close circle of co-workers of A. EIG. During the past several years he established himself as one of the foremost experts in the knowledge of the region covered by POST's "Flora" through his various articles on the wild plants of Palestine, Syria, Transjordan and the Sinai territory, most of which were published in the "Beihefte zum Botanischen Centralblatt". His thesis was considered by the graduation committee to be an accomplishment of considerable and permanent value. In this monograph ZOHARI discusses the ecology of seed distribution and germination of certain plants of our flora. It was quite recently published in the above mentioned journal.

III.

Our congratulations go also to Mr. BENJAMIN ELAZARI-VOLĈANI who was fortunate to make a discovery of very significant biological interest. Until now it had been generally accepted that the water of the Dead Sea is not populated by any living organism. The thought that plants or animals might live here seemed downright absurd because of the extraordinarily high osmotic pressure of the water of this salt-lake par excellence. ELAZARI-VOLCANI succeeded now in isolating different species of bacteria and a green

flagellate (species of *Dunaliella?*) from the plankton of the Dead Sea, which may probably be considered the most halophilic or more correctly the most salt resistant organisms on earth. It may be assumed that the concentration of the salt which had increased more and more after the diluvium, gradually killed most of the organisms which had previously lived there, while only few could resist to this secular process of selection.

Elazari published his discovery in the journal "Nature" and studies at present the biological and biochemical properties of these organisms in the Daniel Sieff Research Institute at Rehovot. Thus the science of hydrobiology, which has as yet been little studied in this country, will receive a new stimulus.

IV.

A Meeting of the Botanical Society of Palestine at Rehovot.

On January 27th, 1937 the Botanical Society of Palestine met at Rehovot where the following two papers were read:

(1) Mrs. de Beer-Wallenstein: "Periodicity of the Formation of Shoots and Buds in Citrus".

Mrs. de Beer-Wallenstein lectured on investigations on the normal periodicity of different Citrus trees made in the Laboratory of Applied Botany *'Gan Moshe'* at *Rishon-le-Tsiyon.*

It was found that in the *Jaffa Orange* new branches never originate from terminal buds, because the end of all branches, with a tuft of leaflets surrounding the terminal growing point, drop at the end of the growing period.

During the winter, when growth stops, the structure of all buds is identical. At the beginning of the growing period, towards the end of January or the beginning of February, when the buds begin to sprout, the first sepals differentiate in a part of the buds. The other parts of the flower are formed during the growth of the branches on which they occur. The lateral and terminal flowers unfold 6 to 9 weeks after the beginning of their differentation.

In the *Poncirus trifoliata* two kinds of buds are found on the branches during the winter period; the larger ones being flower buds. All the parts of the flower are formed before the onset of winter, but they unfold only after the end of the growth interval.

(2) Dr. CHANAN OPPENHEIMER: "Problems of Fertilization of Fruit Trees of the genera *Prunus* and *Pyrus*".

Dr. CHANAN OPPENHEIMER of the Division of Horticultural Physiology and Genetics of the Agricultural Experiment Station at Rehovot reported on his own and other investigations concerning the fertilization of fruit trees of the species *Prunus* and *Pyrus*.

The speaker described the discovery of selfincompatibility by WAITE as well as the various methods applied for further research and discussed shortly the difficulties in comparing the results obtained by various investigators, arising out of the many differences in details between the methods used.

The occurrence of incompatibility with the diploid sweet cherries and almonds, the tetraploid sour cherries, and the hexaploid European plums were described.

The speaker reported his own results with the diploid plums of the *triflora-Simonii* group. The varieties: *Kelsey, Wickson, Satsuma, Burbank, Gaviota* and *Formosa* were found to be selfincompatible in Palestine, while *Santa Rosa* was found to be selfcompatible only to a limited degree. These results agree well with those obtained by HENDRICKSON in California. The varieties *Beauty* and *Climax,* however, which were established to be selfcompatible in California, were found so far to be selfincompatible in Palestine. The variety *Wickson* was shown to be a specially good polliniser. *Kelsey,* however, failed in most cases. No definite instance of interincompatibility could be established so far.

After a short summary of the cytological situation with apples and pears the speaker analysed the literature for evidence concerning the influence of climate on the results of selfpollination. Since most authors do not state the seed content of fruit harvested after selfing, the selfcompatibility itself cannot be used as basis for such a survey, but instead selffruitfulness, including the parthenocarpic setting of fruit has to be resorted to. Furthermore the results of the various authors have to be used considering the technique employed. Such a compilation of data shows for apples that in the interior of the U.S.A. about 90% of the observed varieties were selfunfruitful, in Northern Europe, Russia and the Northwestern States of the U.S. about 80%, in the Atlantic States of the U.S.A. about 60%, in California about 50% and in other, subtropical countries such as South Africa, Crimea and Palestine about 40% of the same varieties. Summarising the observations in the moderate

zone we note that 77% of the observed varieties are selfunfruitful against only 44% in the subtropical countries. For pear the corresponding numbers are 74% and 43%. These figures indicate that in general the same varieties show a greater tendency to selffruitfulness in subtropical countries than in moderate zones.

Among 14 varieties of apples investigated in Palestine two were found to be truly selfcompatible, 11 selffruitful by parthenocarpic fruit set and only one selfunfruitful.

Among 17 varieties of pears none was found to be selfcompatible, eight were selffruitful through parthenocarpic setting of fruit and the remaining ones practically selfunfruitful. The speaker described the differences in the development of parthenocarpic fruits in the presence or the absence of competition with the products of normally fertilized flowers. Thus after selfpollination of a part of the flowers on one tree only very small, economically valueless, parthenocarpic fruits developed, while a tree of the same variety, which had been completely enclosed in a tent gave a full harvest of well developed parthenocarpic fruits. In the case of emasculation and enclosure parthenocarpic fruits were obtained from nonpollinated blossoms with four apple and three pear varieties. If it should be established that such autonomous parthenocarpy guaranteed a normal fruit set, these varieties would become economically very valuable, since a good fruit set seems possible even after an injury of the pistils by the hot, dry winds which occur frequently in Palestine during spring.

In conclusion Dr. Oppenheimer discussed the application of the present knowledge in the field of the biology of fertilization to practical fruit growing. He emphasized that the results of his work up to now are only preliminary in nature.

With the present issue we close the first volume of this publication. Though it is to be regretted that more than one year was spent in publishing it, we note with satisfaction the remarkable interest which it aroused in many countries of the world.

There is founded hope for a more regular service in future. The present editor takes much pleasure in announcing that Dr. Israel Reichert, the outstanding mycologist and plant pathologist and one of the first pioneers of botanical science in this country, has agreed to join the editorial board beginning from the publication of the next volume.

D. ASHBEL:

Evaporation in Palestine

(From the Meteorological Institute of the Hebrew University, Jerusalem)

I.

The measurement of evaporation at a meteorological station gives the measure of the physically possible evaporation under the influence of climatic conditions (temperature, humidity, wind-velocity and barometric pressure). The measurements are taken in the shade where there is *no* direct influence on the part of the sunrays.

In most English and French countries the measurements are usually made with the Piche tube, while most German and Russian regions use the balance of WILD. The measurements in this country were made with the Piche tube. The figures obtained for the rate of evaporation at meteorological stations by means of the Piche tube located in a meteorological screen differ from the actual extent of evaporation in nature, be it from free water surfaces, the soil or plants.

THE EVAPORATION FROM FREE WATER SURFACES

The rate of evaporation from sweet water surfaces differs from that of salt water surfaces. The evaporation is much larger with fresh water than with salt water; the larger the salt concentration the slower is the rate of evaporation from the surface of the solution.

The rate of evaporation from a body of water is in inverse relation to the size of its surface. The larger the surface, the smaller is its rate of evaporation since the dry air that comes from the land absorbs at the beginning of its passage over the water surface a quantity of vapour in proportion to its saturation deficit. Afterwards it continues to pass over the water without causing any further evaporation. But over a small water surface the saturated air passes quickly and is replaced by fresh, dry air which

can absorb additional vapour. Evaporation from long, narrow containers, therefore, is more rapid than from square or round ones of equal size provided their length axis lies at a right angle to the main direction of the wind. The rate is smaller if the length axis of the container is parallel to the direction of air movement.

An important factor in evaporation from a free water surface is the depth of the body of water. If it is deep, evaporation is smaller than in less deep ones since a shallow body of water may increase more rapidly in temperature than a deep one.

The height of the rim of the container above the surface of the water is also very essential. High surrounding walls decrease evaporation considerably, because the wind can not act directly upon the water.

THE EVAPORATION FROM THE SOIL

Evaporation from soil which remains moist during the whole year differs from that of soil which is quite moist at its surface during part of the year only.

In Palestine the soil surface is normally moist only during winter which is at the same time the period of least evaporation. Then the temperature of the air and soil is lowest while cloudiness is most frequent. During summer when the temperature is at its highest and the sky is clear, we also find the maximum physical evaporation, but the surface of the soil in unirrigated areas is dry to a considerable depth and there is nothing which could evaporate from it.

Therefore we can speak of an evaporation from unirrigated land only during those months when water is available for evaporation closely below or upon the surface of the soil.

The rate of evaporation during winter is different on cloudy, rainy days as compared with clear days. On cloudy, rainy days evaporation decreases to zero. As to clear winter days one has to differentiate between quiet, clear, warm days and clear cold days during which the wind blows from North-East to East. Evaporation is slower on clear winter days when no wind is blowing as compared with stormy days even if they are cold (see table 14) in spite of the somewhat higher temperature during the days without wind.

Evaporation is not more rapid on clear, cold days without wind than during cloudy days, while on clear days with strong winds evaporation is very high, and if such days occur after a period

of rain in winter, the moist soil dries quickly. Every winter we may observe the drying out of the soil when rains have been interrupted for a period of two to three weeks or more, to the point of endangering the vegetation on it.

The rate of evaporation from light soils differs from that of heavy soils. It is larger with sandy soil than with with clay. Loose, cultivated soil evaporates its moisture at a different rate than uncultivated, hardened soil. Manured soil and soil with a high humus content hold their moisture in a different way than unmanured soils.

In countries where most rains fall during the summer and only a small amount, up to 25% of the total annual precipitation, in the form of snow during winter, the warm season is also the period of effective evaporation from the soil. In Palestine the rainy season is at the same time a period of cold and of minimum evaporation. During the warm season from July until the first rains no moisture which could be evaporated exists in the Palestinian soil down to a depth of 50 to 60 cm.

Therefore one must not consider the physical evaporation of the entire year and compare it with the quantity of rain which falls during one season only, i.e. during winter. Instead one has to take into account the evaporation during the different growth periods of the various plant species and compare it with the quantity of water be it in form of rain or irrigation water which is available during the particular period.

Table 1.

The Physical Evaporation in Various Regions of Palestine
(in Per Cent of the Yearly Amount)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Haifa	6.2	6.7	7.5	8.0	8.8	9.1	9.1	9.4	9.8	9.4	9.2	6.9
Jerusalem	3.2	3.6	6.3	9.3	12.2	12.5	12.3	11.8	9.1	8.4	6.3	4.0
Jericho	3.9	4.7	6.7	9.1	11.4	12.1	11.9	11.4	9.9	8.3	6.2	4.4

In hydrological calculations 70% of the precipitation is usually accounted for by evaporation and transpiration. It is not yet clear, however, which portion of the 70% evaporates directly and how much of it is due to transpiration of the plants. This is especially undetermined for our conditions. There is a considerable

difference between bare soil and soil which is covered with plant growth.

Everyone experienced in hoeing knows that soil which is not completely covered with plant growth during winter is harder to penetrate with the hoe at the beginning of summer than soil which has been completely covered by plants. Bare soil, therefore, is drier at its surface than that covered with plants. Whether this fact is due to high evaporation from bare soil due to stronger solar radiation and better capillarity of the soil, to the hardening of the soil under the impact of the rain during winter, or to a reduction of penetration of rain water into the soil, can not be determined with certainty without special measurements for this very purpose.

II.

THE PHYSICAL EVAPORATION MEASURED BY MEANS OF THE PICHE TUBE

In Palestine measurements of evaporation were taken before 1914 at a few places by means of circular copper containers with a diameter of 10cm. and a height of 8cm. Measurements made by the station Rephaim[1]) at Jerusalem and a few accidental data from the Jordan Valley[2]) have appeared in print. These data differ so widely from those which were obtained during the years 1920 to 1936 by means of the Piche tube in various parts of this country that we can not use these data at present.

Evaporation was measured by means of the Piche tube at first in the following government stations: Beer Sheba, Gaza, Jerusalem, Jericho, Jenin and Haifa. Later were added to them Beth Shean, Acre, Tel-Aviv, and Beth Jamal. In addition to these stations evaporation was recorded at the following non-government stations: Hebrew University (Jerusalem), North and South ends of the Dead Sea, Tel-Aviv (Mr. Zackay), Petach Tikvah, Mikveh Israel, Pardess Hannah, Ayanoth (near Nahalal), Merhaviah, Givath Hamoreh, Ein Harod (Hugim), Naharaim, Kinereth, Yessod Hamaala. At the North and South ends of the Dead Sea, Jerusalem, Ein Harod, Kinereth and Yessod Hamaala evaporation is also measured by means of the selfrecording evaporimeter of Houdaille, manufactured by Richard, Paris.

1) F. M. Exner, Zum Klima Palaestinas. Ztschr. Dtsch. Pal. Ver. 1910.

2) M. Blanckenhorn, Das Klima das Jordantales. Ibidem 1910.

During the past sixteen years differences were observed in the quantities of water evaporated in the course of different years in corresponding months. There are dry and hot months with considerable evaporation and moist, cool months with little evaporation.

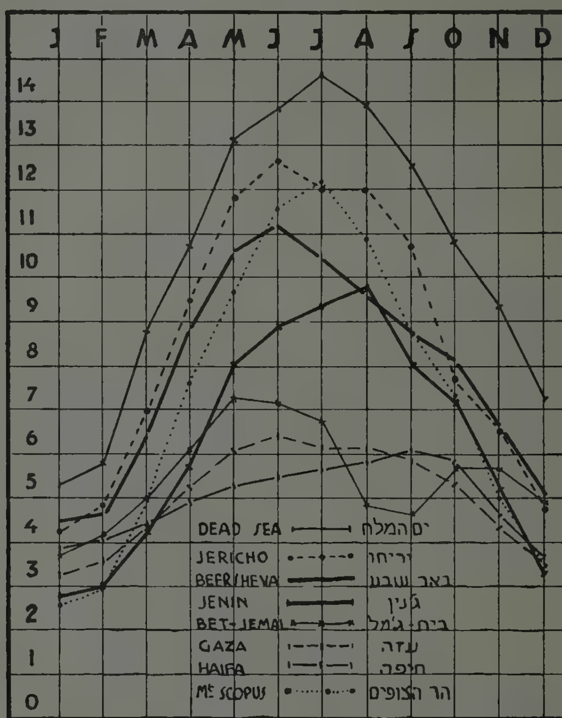


Fig. 1.

Annual march of Evaporation (in millimeters) in various localities in Palestine.

Figure 1 shows the daily average of monthly evaporation. It is clearly evident that the least evaporation during the year takes place in the coastal zone of the Mediterranean. It is larger in the Valley of Yezreel, more so in the mountain zone, still larger in the South and largest in the central and southern part of the Jordan Valley between the Lake of Tiberias and the Dead Sea.

The small amount of evaporation in the coastal plain is due to the high relative humidity found in the air of the sea coast, as well as to the reduced force of the winds (although they are more frequent) and to the relatively low temperature on summer days. The air of the Mediterranean streams during the summer from West to East during the whole day and brings with it a considerable amount of moisture to the shore. In places which are protected from the wind (cities and plantations) evaporation is also lessened during summer to its minimum and there the amount of sweat covering the body of a person is large even if he is not in motion and working. The body sweats, as is well known, whenever evaporation is unable to dry the moisture which is secreted by the skin as *perspiratio insensibilis.*

Table 2.

Average Daily Evaporation in Palestine in mms (1921-36)
(Piche Method).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Beersheva	4.4	4.8	6.6	8.9	10.6	11.2	10.5	9.6	8.5	7.3	6.3	4.9	7.8
Gaza	2.9	3.7	4.3	5.5	6.1	6.4	6.3	6.3	5.9	5.2	4.3	3.6	5.1
Bet Jemal	4.9	4.0	5.1	6.2	7.4	7.0	6.5	5.9	5.4	5.7	5.8	4.8	5.7
Jerusalem	2.0	2.3	3.9	5.9	7.6	7.9	7.7	7.4	5.7	5.3	3.9	2.5	5.3
Jericho	4.1	4.8	6.9	9.3	11.7	12.4	12.3	11.6	10.3	8.5	6.3	4.5	8.6
Haifa	3.8	4.2	4.7	4.9	5.4	5.6	5.6	5.8	6.1	5.8	5.7	4.3	5.2
Acco (1928-36)	5.3	4.6	5.9	5.8	5.9	5.3	5.6	5.8	6.5	6.8	6.5	6.2	5.8
Jenin	2.9	3.1	4.4	5.9	8.3	8.9	8.6	9.2	8.2	7.1	5.4	3.4	6.3
Bet Shean (1928-36)	3.3	3.1	5.4	6.6	9.5	10.2	10.1	9.1	8.3	6.9	5.1	3.8	6.8
Dead Sea (1928-36)	5.1	5.9	9.3	10.9	13.2	14.4	14.4	14.8	12.8	10.9	9.2	7.2	10.6
Merhavia (1933-36)	3.3	2.7	4.6	5.0	6.9	6.9	6.9	6.4	5.9	5.4	5.1	3.7	5.25

Evaporation at the coast is small in summer and large in winter as compared with other regions (see table 1). This is due to the fact that the air along the seashore is warmer during winter and cooler during summer than in the areas remote from it.

Table 3.

Average Yearly Rainfall & Evaporation Power (in mms)

	Rainfall	Evaporation power		Rainfall	Evaporation power
Beersheva	200	2842	Merhavia	480	2000
Gaza	380	1860	Jenin	500	2300
Bet Jemal	500	2080	Dead-Sea (north)	80	3750
Jerusalem	665	1931	Jericho	190	3140
Haifa	630	1900	Bet Shean	300	2480
Acco	600	2118	Yessod Hamaala	600	1780

The 'coastal zone' does not extend far inland from the sea-shore but remains within a few kilometres of it. Already a short distance from the shore the continental character is more pronounced as evidenced by a considerable increase of the temperature during the day and a significant decrease at night. Right at the sea coast the temperature remains lower during the day, sinking less at night than in the surrounding region (Table 4).

Table 4.

Mean Summer Temperature at Tel-Aviv and Kalmania.

	Tel-Aviv (Sea Coast)			Kalmania (10 km East of the Sea)		
	Mean		Mean	Mean		Mean
	Maximum	Minimum	of day	Maximum	Minimum	of day
April 1936	22.2	14.1	18.2	27.5	7.6	17.6
May	26.6	19.2	22.9	31.0	14.1	22.6
June	28.7	21.6	25.2	31.1	17.1	24.2
July	29.8	23.0	26.4	31.2	17.1	24.2
August	31.2	23.1	27.2	31.5	18.8	25.2
September	27.3	24.4	25.8	30.4	18.2	24.3

In the mountains where the temperature is on a whole lower than at the coast, evaporation might be expected for this reason to be smaller. The dryness of the region (absence of water surfaces) however, and the existing strong winds bring about a stronger evaporation in summer than at the coast. The small amount of moisture in the air and the intensity of the wind increase the

evaporation in the mountains over that in the lower regions near the coast.

In the Jordan valley we have to differentiate between its northern part (Huleh) which is 70 meters *above* sea level, its central part which is 200 to 250 meter *below* sea level and the vicinity of the Dead Sea which is 392 meters *below* sea level.

Moreover one has to distinguish between regions near to a lake and desert parts which are far from any bodies of water. The northern part of the Jordan valley is a district of large swamps, and there evaporation is comparatively low, while the temperature is not as high and the relative humidity of the air is higher than in the remaining parts of the Jordan valley. Evaporation is especially reduced during winter. Then the air is saturated and the temperature low. The fact that this region is close to high mountains (Hermon) is felt in the valley by a lowering of the temperature at night. This vicinity to high mountains also causes a high cloudiness during rainy days as well as a larger amount of rain than in the other parts of the Jordan valley.

Table 5.

Evaporation during 1936 in the Jordan Valley (in mms)

(Piche method)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Yessod Hamaala	2.6	2.7	3.2	3.8	6.7	7.3	7.3	6.7	6.6	5.1	3.5	3.8	4.9
Beisan	2.8	3.8	5.2	6.5	7.7	11.1	—	8.7	8.0	7.4	5.0	2.4	—
Jericho	3.6	4.8	6.4	7.2	9.1	9.7	10·6	8.3	8.2	7.8	4.8	2.5	6.9
Dead Sea	5.8	7.2	8.7	10.7	12.6	14.0	14.5	13.5	11.7	11.7	8.7	7.5	10.55

THE DAILY MARCH OF EVAPORATION

The daily march of evaporation in most parts of the country is as follows: When the temperature increases during the forenoon, evaporation also increases. And when the temperature decreases during the afternoon, evaporation also decreases. It runs more or less parallel to the temperature curve during the day. In winter the curve of evaporation in the Jordan Valley is similar to that of other regions; during the summer, however, it changes due to the special

wind system which affects temperature and moisture. In the southern part of the valley, on the northern shore of the Dead Sea, for example, the temperature during the summer does not reach its maximum at about 1 or 2 p.m. as is usually the case, but rather nearer to the time of sunset.

A southern cool and moist wind blows on the northern shore of the Dead Sea during summer days about at noon, which is in other zones the hottest time. While it begins to blow from the water surface towards the dry land in the north it cools the air 2 to 3°C and sometimes even 5° as compared with the previous temperature. While this southern wind blows, the temperature can not reach its maximum. Only after this wind stops and instead a strong west wind sets in from the Judean mountains — usually after an interval of barely an hour — the temperature increases to its daily maximum, leaping suddenly for several degrees.

The reason for this sudden rise in temperature is the adiabatic heating of the air which descends from the hills. While falling from the mountains of Jerusalem, which have during the summer a barometric pressure of 685 mm, to the Dead Sea with its 785 mm. barometric pressure, the air is compressed and its temperature is raised 1°C for every hundred meters. Since there is a difference in height of 1200 m. between the mountains of Jerusalem and the Dead Sea, this increase may amount to as much as 12°C above the temperature of the air on *top of the mountains before it has moved downwards!*

The increase in temperature near the Dead Sea, however, is not high as that since the temperature there had been already previously quite high. This actual difference in temperature may be recognised on the curve, and amounts generally to about 3 to 5°C. In exceptional cases, however, there may be in spite of it an increase in temperature up to 10°C as for example on June 1st, 1936. By necessity the amount of moisture which was previously present makes up a much smaller percentage of relative humidity after the air increased in temperature during the descent. While sinking, air becomes warmer and drier. Therefore evaporation is very high during these hours (Fig. 2).

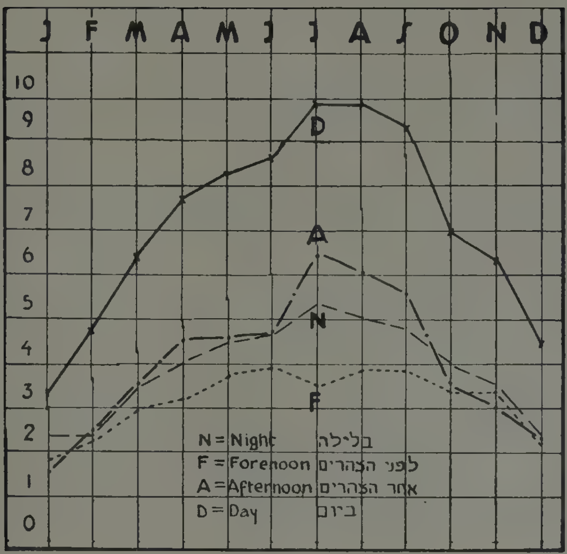


Fig. 2.

Annual march of evaporation at the Dead Sea (day, night, forenoon and afternoon).

At the Lake of Tiberias one may also distinguish between the wind which comes from the water and the wind which comes during the summer afternoons from the western mountains. The decrease in temperature due to the wind which comes from the water at noon is, however, not as pronounced at Tiberias as at the northern coast of the Dead Sea. The adiabatic increase in temperature is here also smaller with the westerly wind than is the case at the Dead Sea, since the difference in altitude between the Lake of Tiberias and the surrounding mountains is not so great. For the same reason evaporation at the Lake of Tiberias during those hours is not as high as that found during different times of the day at the shore of the Dead Sea.

Table 6.

Departure of Evaporation from the Hourly Mean at Yessod-Hamaala

(Upper Jordan Valley; + 70m)

Hour	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	—04		—03	—11	—13	—23	—22	—21	—09	—15	—05	—02
1	—04		00	—12	—20	—17	+11	—10	—09	—18	—07	—03
2	—04		—01	—11	—24	+18	+11	—15	—14	—21	—11	—05
3	—04		—04	—09	—23	—02	+11	—19	—14	—17	—10	—02
4	—05		—09	—12	—21	+20	—01	—16	—22	—20	—12	—04
5	—05		—11	—14	—18	—27	—24	—28	—19	—22	—14	—04
6	—05		—11	—13	—17	—35	—42	—23	—19	—23	—13	—05
7	—06		—03	—16	—01	—33	—43	—31	—29	—28	—17	—07
8	—05		—08	—12	—11	—36	—44	—32	—29	—29	—17	—07
9	—05		—06	—02	+02	—22	—27	—14	—19	—14	—14	—05
10	—03		—05	—03	—04	—10	—25	—10	—20	—04	—11	—06
11	+02		+01	+05	+13	+20	—04	+10	+03	+12	+06	00
12	+04		+02	—12	+12	+28	—01	+14	+06	+20	+09	+02
13	+08		+09	+11	+19	+48	+26	+31	+26	+33	+21	+09
14	+08		+10	+17	+32	+46	+23	+31	+31	+32	+20	+08
15	+11		+14	+17	+41	+54	+52	+48	+44	+45	+26	+13
16	+10		+20	+19	+21	+38	+61	+46	+43	+39	+20	+10
17	+08		+12	+22	+19	+25	+43	+34	+43	+35	+17	+07
18	+05		+02	+23	+14	+09	+37	+30	+25	+17	+09	+05
19	+02		—01	+07	+05	—05	+20	+17	+11	+10	+03	+04
20	+01		00	—01	—10	—04	—05	+14	—02	+01	+07	00
21	—02		—07	—08	—01	—19	—23	—08	—06	—02	—01	—01
22	—02		—06	—05	+02	—25	—24	—14	—09	—09	+04	—05
23	—02		—05	—07	—16	—34	—16	—22	—15	—13	—02	—05

Table 7.

Departure of Evaporation from the Hourly Mean at Kinereth.
(— 190 m)

Hour	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	−03	−05	−08	−08	−11	−10	−28	−24	−18	−13	−06	−03
2	−04	−07	−09	−12	−15	−11	−34	−29	−20	−15	−06	−04
4	−05	−07	−09	−15	−13	−13	−38	−30	−23	−14	−06	−04
6	−05	−07	−10	−19	−16	−16	−41	−32	−25	−17	−05	−03
8	−03	−02	−06	−14	−08	−14	−28	−23	−21	−08	−05	−07
10	+02	00	−05	−03	−04	−04	+08	+05	−03	+04	−07	00
12	+03	+08	+05	+10	+13	+09	+34	+29	+11	+12	+05	+07
14	+05	+08	+13	+19	+23	+19	+50	+50	+39	+20	+06	+06
16	+05	+10	+24	+33	+18	+25	+57	+52	+45	+22	+08	+06
18	+05	+03	+12	+20	+16	+15	+29	+26	+23	+25	+05	+04
20	00	00	−01	+03	+04	+04	−02	−04	+01	+02	+01	+02
22	−03	−04	−06	−05	−04	−02	−20	−17	−11	−09	−02	+01

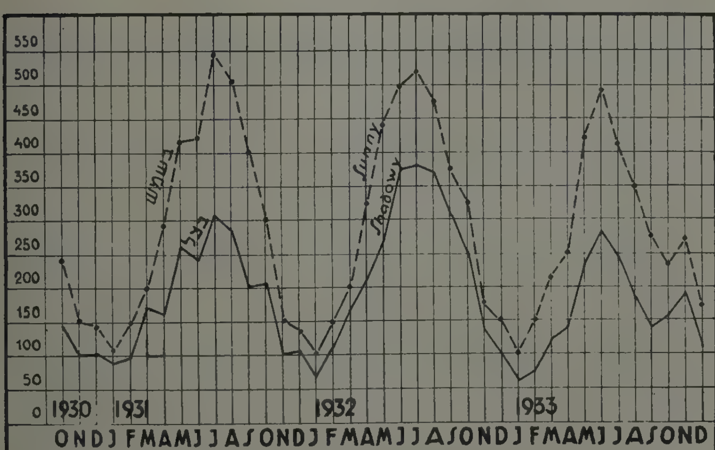


Fig. 3.

Evaporation at Jerusalem (Sun and Shadow Values) from October 1930, till December 1933.

Table 8.

Departure of Evaporation from Hourly Mean at Dead Sea (North End)

(391m below Sea Level)

Hour	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	—08	—10	—08	—07	—07	—07	—09	—07	—11	—10	—12	—10
1	—07	—14	—14	—12	—25	—07	—28	—22	—25	—18	—11	—09
2	—08	—11	—13	—11	—20	—23	—29	—25	—31	—18	—09	—10
3	—06	—07	—20	—38	—35	—36	—42	—27	—34	—19	—11	—09
4	—06	—08	—22	—37	—34	—57	—41	—34	—37	—14	—11	—12
5	—09	—07	—21	—35	—32	—52	—54	—47	—39	—21	—11	—10
6	—10	—11	—21	—33	—21	—39	—55	—39	—31	—09	—12	—14
7	—06	-08	—15	—33	—23	—28	—52	—45	—27	—10	—30	—09
8	—05	+02	—05	+06	—03	—18	—41	—22	—09	+07	+03	—11
9	—02	+03	—06	+13	—12	—24	—33	—25	+07	+10	+14	—03
10	+03	+12	+01	+18	—04	—04	—12	—02	+17	+20	+23	—05
11	+11	+08	+10	+16	—05	—02	—01	+06	+07	+21	+27	+06
12	+10	+07	+19	+14	+06	+13	+09	+14	+23	+15	+29	+14
13	+11	+07	+18	+08	+01	—02	—01	—12	00	+02	+25	+18
14	+09	+12	+24	+07	+11	—05	00	+07	+06	+04	+28	+18
15	+21	+10	+22	+05	+02	—06	—06	+13	+05	—03	+21	+17
16	+13	+09	+25	+07	+41	+21	+18	+54	+07	+04	+16	+12
17	+07	+05	+16	+30	+43	+68	+75	+67	+21	+11	+09	+13
18	+02	+04	+12	+30	+44	+75	+105	+51	+31	+06	—02	+03
19	+05	—02	+12	+30	+31	+58	+81	+33	+47	+13	—04	+01
20	—05	—03	+17	+24	+30	+58	+63	+35	+49	+17	+01	—03
21	—10	—06	+04	+24	+15	+14	+45	+22	+17	+15	—06	—01
22	—08	—03	—07	+26	+06	+13	+10	+03	+06	+12	—02	—10
23	—08	—06	—13	+15	—01	+01	00	—08	+04	—03	—12	—08

Table 9.

Departure of Evaporation from the Hourly Mean at Jerusalem (Hebrew University)

Hour	June 1936	July	Aug.	Sept.	Oct.	Nov.	Dec.	January 1937
0	—21	—29	—20	—11	—11	—02	—03	00
1	—26	—26	—23	—15	—10	—07	—03	—01
2	—26	—26	—26	—14	—16	—07	—03	—01
3	—27	—29	—29	—13	—20	—08	—05	—01
4	—25	—30	—27	—22	—24	—09	—05	—01
5	—28	—31	—27	—26	—24	—09	—06	—02
6	—31	—31	—29	—26	—24	—09	—03	—02
7	—25	—23	—22	—17	—09	—07	—05	—02
8	—14	—13	—21	—13	+17	—08	—07	—01
9	—09	+07	+13	+08	+13	—01	—03	—10
10	00	+23	+08	+11	+16	+06	+01	—01
11	+14	+26	+29	+21	+21	+13	+04	00
12	+40	+42	+31	+24	+21	+14	+05	+01
13	+46	+48	+39	+34	+26	+18	+06	+02
14	+47	+42	+42	+33	+27	+15	+06	+04
15	+48	+50	+43	+22	+29	+13	+04	+05
16	+45	+45	+37	+21	+22	+08		+05
17	+31	+32	+16	+12	+09	+01	+03	+02
18	+18	+19	+14	+08	+04	—02	+02	+04
19	+04	—02	—09	—06	—08	—02	+01	+01
20	—11	—19	—15	—09	—10	—03	00	00
21	—17	—27	—14	—09	—07	—03	—02	00
22	—20	—25	—14	—11	—05	—03	—01	00
23	—20	—28	—15	—09	—08	—03	—03	—01

EVAPORATION ON HOT AND COLD SCIROCCO DAYS

The very large number of *Sharav* (hot Khamsins or hot Sciroccos) and *Kadîm* (Sharkias or Cold Sciroccos) days are important causes affecting the high amount of annual evaporation in the mountains. On the average these days with dry winds number in the mountain region about 170 during the year. This means that an easterly wind blows, warm in spring and autumn, if it comes

from the south-easterly or easterly direction and cold in winter if it comes from the north-easterly to easterly direction, during 46% of the total number of days throughout the year. During hot Khamsin days the air temperature at the top of the mountains is not lower than that in the valleys. Sometimes during the first Khamsin days it is even higher than in the low regions at the shore (Table 10). The moisture in the air of the mountains is at such times very low and the saturation deficit very large. Accordingly a very high evaporation takes place from all objects which contain water in any form whatsoever.

Table 10.

Temperature at the Coast (Tel-Aviv) and in the Mountains (Jerusalem) on Scirocco Days (°C)

1935	Jerusalem (830 m) Maximum	Jerusalem (830 m) Minimum	Tel-Aviv (15 m) Maximum	Tel-Aviv (15 m) Minimum
21/4	21.0	5.5	—	—
22/4	16.5	6.0	—	—
23/4	20.8	7.3	—	—
24/4	28.0	19.0	27.5	12.2
25/4	27.1	15.5	23.5	12.3
26/4	**30.0**	16.4	24.8	14.2
27/4	**34.0**	**22.4**	28.3	17.0
28/4	**35.0**	**22.5**	29.9	19.5
29/4	**33.0**	**22.1**	25.2	19.3
30/4	**34.0**	**23.0**	19.5	18.0
1/5	**37.0**	**25.0**	**39.6**	**21.0**
2/5	**37.1**	**25.0**	**40.5**	**25.2**
3/5	**33.8**	18.0	30.5	**26.3**
4/5	25.0	12.5	21.3	24.0
5/5	26.0	12.5	22.3	17.6
6/5	23.5	13.9	20.2	15.7

Table 11.

Air Temperature during hot Scirocco (°C).

Date 1936	Jerusalem Max.	Jerusalem Min.	Beer-sheva Max.	Jericho Max.	Jericho Min.	Bet Jemal Max.	Bet Jemal Min.	Tel-Aviv Max.	Tel-Aviv Min.	Acco Max.	Acco Min.	Jenin Max.	Jenin Min.	Beisan Max.	Beisan Min.
19/4	24.3	17.4	36.0	35.0	23.0	25.4	18.6	24.2	20.2	24.0	9.5	26.3	16.2	30.5	20.0
20/4	18.7	10.0	33.1	29.5	17.6	21.4	13.8	23.2	17.9	22.5	16.0	28.1	14.3	26.5	14.0
21/4	26.4	7.0	32.0	33.0	13.6	28.2	10.5	23.7	11.2	23.0	8.5	28.9	7.5	32.5	8.5
22/4	32.6	12.1	39.0	38.0	16.0	36.4	17.5	38.5	12.1	40.0	12.0	38.8	14.7	38.5	15.5
23/4	36.3	11.9	41.1	43.0	21.0	39.4	30.4	38.5	23.5	41.9	24.0	40.5	21.7	42.3	21.0
24/4	34.3	22.7	38.6	41.5	26.5	37.3	22.8	28.0	21.0	39.8	22.0	38.9	24.0	41.0	26.4
25/4	19.3	11.7	38.6	30.6	20.7	22.1	14.8	23.3	18.5	23.6	16.5	30.4	15.2	27.0	18.0
26/4	23.4	8.3	35.5	23.0	15.3	24.8	11.5	23.0	12.4	22.0	11.7	28.2	14.6	30.5	12.0

Table 12.

Evaporation during hot Scirocco (in mms)

(Piche method)

Date 1936	Jerusalem	Beersheva	Jericho	Bet Jemal	Acco	Jenin	Beisan
19/4	4.1	5.6	7.8	—	4.5	8.2	8.4
20/4	3.7	6.5	7.2	3.7	4.5	7.1	6.0
21/4	8.6	10.5	6.8	4.1	5.0	7.9	8.0
22/4	11.3	21.6	10.0	9.4	12.0	18.7	12.0
23/4	16.2	18.4	14.3	18.0	15.0	19.6	14.0
24/4	8.4	12.8	11.3	15.5	18.0	10.4	11.0
25/4	4.4	6.9	7.2	9.8	9.0	7.9	7.0
26/4	4.0	6.7	6.5	4.5	4.5	6.8	6.2

A somewhat different phenomenon than the Khamsin is the Kadim (cold Scirocco). Its appearance is peculiar not only to the mountains but also to the lower parts of the country. Contrary to the Sharav (hot Scirocco) which, except in the South, is a rather weak wind, the Kadim is a very strong wind from East to North-East. The Kadim occurs only during the winter and then the temperature is very low, while the sky is frequently clear and the sun bright. The relative humidity of the air is equally low as during Sharav days. The vapour pressure is the main difference between

Sharav and Khadim. During a Sharav, when the temperature is high and the relative humidity very low, the saturation deficit is large. During the Kadim, however, the maximium vapour pressure can not be high on account of the low temperature. In spite of this the relative humidity of the air reaches 15 to 20%, resulting, therefore, in a rather high potential evaporation. The strong and very dry wind brings about as large an evaporation as that customary during warm days.

Table 13.

Air Temperature (°C) during the Cold Scirocco
December 7th to 20th, 1936.

Date 1936	Jerusalem		Beersheva		Jericho		Bet Jemal		Acco		Jenin		Beisan	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
7/12	14.0	7.3	16.4	9.5	22.0	11.0	17.7	8.5	20.8	10.8	20.0	10.2	19.5	9.0
8/12	14.0	7.5	18.2	7.2	21.0	11.0	17.2	10.6	18.4	8.0	19.3	8.4	19.0	9.0
9/12	15.0	6.0	19.6	6.5	22.0	12.8	20.6	11.1	22.2	11.4	19.6	8.8	20.5	10.0
10/12	12.0	2.7	20.0	6.6	20.3	10.0	17.0	10.6	20.2	8.6	19.9	8.3	21.5	10.0
11/12	12.0	0.0	20.2	9.5	20.0	5.8	14.0	7.0	18.5	5.1	17.7	6.2	20.0	6.5
12/12	8.6	0.9	18.2	10.0	18.3	3.3	13.8	5.9	17.6	5.7	16.5	3.1	19.0	4.0
13/12	8.9	1.7	16.0	7.0	20.0	4.6	13.2	5.9	17.4	5.7	17.4	4.2	18.0	4.0
14/12	7.7	1.1	16.0	4.9	19.0	6.5	11.8	7.0	18.0	8.2	16.9	5.9	18.0	2.0
15/12	6.9	2.3	14.0	7.2	19.5	7.5	12.2	7.0	18.0	6.0	16.2	4.7	20.0	6.0
16/12	10.3	4.1	13.1	8.2	21.5	8.0	15.3	7.5	19.0	6.9	16.4	6.2	21.6	7.0
17/12	13.0	5.8	21.6	7.0	22.5	8.0	21.5	9.6	20.5	11.5	17.9	7.8	20.2	10.0
18/12	15.0	7.0	21.2	10.0	21.0	8.5	18.6	10.5	20.8	8.5	20.9	7.7	21.5	10.5
19/12	12.8	5.0	21.5	10.5	21.0	10.0	17.7	10.3	18.0	7.6	19.5	7.2	22.5	10.5
20/12	—	—	22.5	10.5	20.7	9.0	—	—	—	—	—	—	—	—

Low humidity and strong winds bring about considerable evaporation which is quite dangerous to the tissues of young growth. A strong Kadim at the time of sprouting causes a very high percentage of drying up of sprouts. A similar process can be observed during a Sharav with fruit trees at the time of flowering. During a strong and extended Sharav a large percentage of blossoms and small fruits dry off and drop. The same is true for spikelets of grain during the milk stage.

Table 14.
Evaporation (Piche) during the cold Scirocco (in mms)
December 7th to 20th, 1936.

Date 1936	Jerusalem	Beersheva	Jericho	Bet Jemal	Acco	Jenin	Beisan
7/12	0.9	2.7	2.4	2.7	2.0	1.5	1.0
8/12	2.3	5.1	5.0	1.4	6.4	2.8	2.0
9/12	2.2	4.5	3.8	4.8	5.8	3.1	5.0
10/12	2.8	5.2	4.0	4.2	6.1	4.6	5.0
11/12	3.5	6.1	3.7	5.9	8.0	5.8	4.0
12/12	**4.1**	8.2	4.5	5.8	4.0	5.9	3.0
13/12	**4.5**	**9.5**	5.1	**8.7**	**13.8**	**7.7**	5.0
14/12	**6.0**	**9.5**	**8.4**	**11.9**	**12.5**	**8.0**	4.0
15/12	**5.9**	**11.5**	**6.0**	**12.9**	**18.0?**	**9.9**	**7.0**
16/12	**5.6**	**10.5**	**7.0**	**13.7**	**18.9?**	**8.3**	**9.0**
17/12	2.5	4.5	3.7	**11.9**	3.4	5.4	6.0
18/12	2.0	2.9	3.3	4.1	—	3.5	**9.0**
19/12	—	—	—	2.7	—	3.9	6.0

Table 15.
Wind direction and velocity during the cold Scirocco
December 7th to 20th, 1936.

Date 1936	Jerusalem	Beersheva	Jericho	Bet Jemal	Acco	Jenin	Beisan
7/12	W1	E1	C	S1	—	WSW2	ESE1
8/12	NE1	S1	N3	E1	E2	WSW2	E2
9/12	NE2	E1	NNE^3	E2	SSE2	ENE1	ENE4
10/12	NE2	E2	N3	E3	NE2	ENE2	ENE4
11/12	ENE2	E3	N2	E4	SSW2	ENE2	ENE4
12/12	ENE2.3	E4	NNW3	E4	E5	ENE2	E4
13/12	ENE2.3	E4	N2	E7	SE7	ENE2	E5
14/12	ENE2.3	E4	E3	E7	NE3	ENE3	.
15/12	ENE3	E4	C	E7	SE6	ENE3	E4
16/12	ENE3	E4	NE2	E6	E^5	ENE3	ENE4
17/12	SE1	E8	NNW2	SE2	ESE5	ESE2	ENE3
18/12	SE1	E1	N1	N2	SW1	ESE1	E1

The freezing of parts of the plant during very cold Kadim days, which is mainly caused by an internal tearing of the tissues is a problem which is not concerned with evaporation alone. Mainly those plants suffer which are situated at the East side of the plantation and are exposed to the strong, cold and dry Kadim. It would be frequently possible to weaken this influence of the wind by means of windbreaks at the *eastern* border of the plantation.

SUMMARY

The author summarizes the available data on evaporation measurements carried out in the various climatic regions of Palestine by means of the PICHE tube. Evaporation is relatively low along the sea-shore and in the swampy Huleh region, larger in the Yezreel Plain and in the Cisjordanian hills rising to very considerable values in the southern steppic zone and in the Dead Sea basin (see tables 1 and 2).

In all parts of Palestine the evaporation power of the atmosphere exceeds by far the amount of annual precipitations creating adverse conditions for the life of plants with an extended growth cycle (table 3).

The daily march of evaporation follows in general that of temperature. Peculiar conditions prevail on summer days in the Jordan Valley where evaporation rises to its daily maximum in the late afternoon hours (tables 6, 7, 8).

Evaporation is very high on *Sharav* (hot Scirocco) and *Kadîm* (cold Scirocco) days (tables 12-14). Plantations of sensitive plants ought to be protected at their eastern borders against the desiccating effect of these winds.

S. HURWITZ:

Vernalization Experiments with Potatoes.

(From the Division of Agronomy of the J.A.P. Agricultural Experiment Station, Rehovot)

The theory of vernalization rests on the assumption that plant growth periods are variable. Formerly it had been commonly accepted that every species was characterized by a definite growth period which was in general only alterable within narrow limits, particularly when climatic factors were taken into account. This belief was shaken by experiments on the conversion of winter crops into summer crops. Experiments on the periodicity of illumination moreover showed how the period of growth could be shortened considerably.

A close correlation binds the length of the growth period with the quantity of the harvest. A variety with a long growth cycle yields a greater crop than a variety with a short growth cycle. This is to be expected. A long period of growth naturally permits of assimilation during a longer period and accumulation of more organic substance. If such relationship exists, it seems aimless, however, to attempt a shortening of the period of growth. This would only lessen the yield. LYSENKO however doubts the existence of such a proportionality. "What we are accustomed to call 'period of growth' in plants is not a firmly fixed whole, but a chain composed of many links, each with its own optimum. Each phase requires different conditions of humidity, illumination, darkness, temperature, food, etc. and is itself composed of two periods: In the first the plant accumulates dry matter, grows in thickness and height, or increases the number of its leaves, roots, etc. In the second period, the 'period of development', morphological changes take place. The first period bears a quantitative, the second a qualitative character. But there is no antagonism between both periods. Given measures lead the plant concomitantly to grow and to pass from one phase to another. In practice, however, such an antagonism exists, since the plant does not always find the optimal conditions for all the various periods under natural conditions.

Lysenko's views are consistent with the theory advanced by Ljubimenko. According to the latter, the growth of the plant consists of three processes which follow one other in time: (1) the accumulation of the primary assimilatory products; (2) the transformation of these into living protoplasm; (3) the formation of cells, tissues, and organs. The transformation of the products of assimilation into protoplasm depends upon a series of chemical processes most of which are unknown. We are similarly ignorant as to the factors which accelerate or slacken these processes. Moreover, the products of assimilation are not always directly transformed into living protoplasm, but may be stored as reserve substances. It follows that growth is itself insufficient to bring about the morphological differentiation. Conditions may not allow of normal growth and the plant may remain dwarfed, yet the normal progress of development remains unaltered.

It is known that carbon dioxide assimilation does not occur during all hours of the daylight, but only during a comparatively brief interval. The principal reason for this, according to Ljubimenko, is the slow consumption of the assimilatory products by the tissues, and the slow progress of cell and tissue formation. The velocity of plant growth is therefore in general limited by the latter processes.

This brings us to the fundamental assumption of the theory of vernalization: The influence of the various factors is not necessarily connected with certain phases of development. If, for instance, in a certain period of plant development a certain temperature leads to ear formation, then the application of this temperature in another phase of the plant's development, e.g. in the phase of germination, will exert a similar influence, assuming of course that temperature is not applied alone, but as one of the full complex of factors necessary to the plant for ear formation.

As far as we know, the validity of this assumption has been tested by experiments for germinating seeds only, but not for green plants. Experiments undertaken by the author on winter rye with a view to elucidate the length of the period of growth (which is influenced principally by cold) led to very different conclusions. Numerous experiments by Lysenko and others seem to have established however that the above assumption is valid for the phase of germination.

Lysenko's theory of vernalization stands in sharp contrast to the theory of photoperiodism advanced by Garner and Allard. According to Lysenko, a periodic change of day and night is unnecessary for the growth of plants. They can grow as well under conditions of permanent illumination, provided that they receive a sufficient amount of darkness in a certain phase of their development. Hence the value of darkness in the development of plants, for not only the length of the day is important, but also the length of the night.

The low harvests resulting from an abbreviation of the vegetative period are not explained by antagonism between the period of vegetative growth and the period of reproduction, but by the reduction of the time period available for carbon assimilation. If the plant is provided with the necessary amount of darkness in an early period of its life, it may be given larger quantities of light later on, and it will assimilate more intensively, accumulate more organic matter, and grow quicker. In contrast to the law of proportionality between the period of growth and the amount of the yield, Lysenko affirms the proportionality between the rate of accumulation of organic substance and the intensity of regenerative development.

The possibility of vernalizing potatoes is of common interest. From the botanical point of view, the potato tuber represents a thickened subterranean stem. We are interested here, not in the production of fruit, but of tuber. The problem is further complicated by the fact that the group to which the potato belongs, by virtue of its reaction to various amounts of light and darkness, has not yet been definitely fixed. Potatoes grown under continuous illumination, form much organic matter in shoots and leaves, but tuber formation proceeds rather slowly. If potato plants are transferred from short day to long day conditions, the growth of the tubers is checked, and under the influence of illumination the tubers may even disappear. For this reason, the potato plant has been listed among the short day plants. On the other hand, it could be established that potatoes do form tubers under permanent illumination, if subject to a given temperature.

An interesting investigation bearing on this subject was published by Eichfeid (1), a student of the Experimental Station at Hibiny in the far north of Russia. He found that constant illumination with polar light at the low temperature characteristic for this region

has an influence different from constant illumination in a greenhouse. The resulting crops were often larger than at Leningrad and always larger than those of Southern Russia (Odessa, Southern Caucausus). According to this author, temperatures between 12 and 15°C are optimal for tuber formation. With rising temperatures, yields drop and at 25—30°C no tubers are formed.

Upon this then is the practice of potato vernalization founded: permanent illumination at constant temperatures.

New researches have been carried out on potato vernalization, and the results have been somewhat inconsistent. Some authors reached the conclusion that with potatoes the real value of vernalization lies not as much in the abbreviation of the vegetative cycle as in the raising of the yield. Results of great importance were published by FOKEEV and VYROW (2,3) working in the Middle Volga District. Vernalized potatoes ripened their tubers one month before control plants. The yield of the vernalized plants amounted to 4000 kg. per ha, instead of 1500 kg. per ha on the control plots.

VAN HOEK (4), on the other hand found only a small rise in yield: 22,270 kg. instead of 20,624 kg. from 23 hills. The vernalized potatoes yielded a larger quantity of green stems and leaves, and these dried up six days earlier than was the case with the control plants. The rise in the yield as well as the shortening of the vegetative period are within the limits of probable error, and therefore of a doubtful significance.

EXPERIMENTS WITH POTATOES SOWN IN AUTUMN

Four varieties were used which were chosen from a greater number tested in variety testing experiments: *Up to date, Majestic, Fruehgold* and *Edelragis*. It was necessary to repeat the experiment twice during the same season, as in the first experiment nearly all the potatoes were lost. This loss was due to the fact that the tubers had been pierced by metallic needles so that they might be strung on threads. This promoted infection with rot. In the second experiment, the tubers were pierced by means of a wooden splinter and strung on threads. During the day time they were exposed in the open air to the natural light of the sun, and at night they were transferred indoors and illuminated by a 200 watt lamp hanging at a distance of 40 cm. This procedure was repeated for 24 days. Afterwards the potatoes were planted in the field. For technical reasons the planting had to be delayed until almost the middle of September. We were

unable to detect any important differences in the growth of the vernalized and the unvernalized plants. As Table 1 shows, there were as well no consistent differences as to their yield.

TABLE I.

Yield of Vernalized and Unvernalized Potatoes
(grams per hill)

Varieties*)	UNVERNALIZED		VERNALIZED	
	Grams	Percentage	Grams	Percentage
A	450	100	460	102
B	435	100	400	92
C	400	100	429	107
D	275	100	205	74

EXPERIMENTS WITH POTATOES SOWN IN SPRING

The vernalization experiment was repeated in spring in order to establish whether or not vernalization is effective at this season of the year. This time six varieties, in part different from those mentioned above, were selected from among the material of the variety testing experiments: *Up to date, Edelragis, Konsuragis, Schneeragis, Wekaragis, Fruehbote.*

In various papers on vernalization of potatoes we found different directions for the arrangement of the tubers: Some authors recommend hanging the threads in a vertical position, others prefer a horizontal arrangement. Though it seemed to us unlikely that there should be any a priori differences in this respect, we decided nevertheless to try both systems. We also endeavoured to find out whether the quality of the light used during the day has any influence. For this purpose, one portion of the potatoes was exposed to electric light during the whole period of illumination. Another portion received electric illumination at night and natural sunlight during the day from 7 o'clock in the morning to 4 o'clock in the afternoon. A third portion was transferred every morning from the illuminated room to the open air, though not to the direct sunlight, and then returned to the room again in the evening. Part of the potatoes continued under these treatments for 21 days, others for 30 days.

*) We designate the varieties by symbols, in order to avoid premature conclusions as to their value.

TABLE IIA.

Observations on Vernalized Potatoes and Their Yield.

Treatment	Length of Illumination Period in Days	Variety "E"					Variety "F"					Variety "G"				
		State of the Potatoes at the Time of Plantation					State of the Potatoes at the Time of Plantation					State of the Potatoes at the Time of Plantation				
		State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant	State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant	State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant
Potatoes hanging vertically. Uninterrupted illumination by electric light	30	good	2	1.0	600	12	—									
Potatoes hanging vertically. Electric light during the night and sunlight during the day	30	,,	3	0.7—1.0	840	13	—									
Potat. hanging horizontally. Uninterrupted illumination by electric light	30	,,	4	0.7—1.1	860	13	good	5	0.8—1.0	700	20	soft	3	0.8—1.0	777	18
Potat. hanging horizontally. Electric light at night and direct sunlight during the day	30	somewhat shrivelled but good	4	0.8—1.0	800	14	,,	4	0.7	740	18.5	somewhat shrivelled	2	0.5—0.9	738	16
Potat. hanging horizontally. Electric light at night and diffuse sunlight during the day	30	Fair	4	0.6—0.8	860	13										
Potat. hanging horizontally. Electric light at night and direct sunlight during the day	21	somewhat shrivelled	3	0.6—1.0	900	14	good	3	0.9	650	18	soft	2	0.5—0.9	765	16.5
Control potatoes	—	good	2	0.8	920	13	good	2	1.0	760	17	good	2	0.9—1.0	782	14

TABLE IIB.

Observations on Vernalized Potatoes and Their Yield.

Treatment	Length of Illumination Period in Days	VARIETY "H"					VARIETY "J"					VARIETY "K"				
		State of the Potatoes at the Time of Plantation					State of the Potatoes at the Time of Plantation					State of the Potatoes at the time of Plantation				
		State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant	State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant	State of Health	Number of Sprouts	Length of Sprouts (cm.)	Yield per Plant in Grams	Number of Tubers per Plant
Potat. hanging horizontally. Uninterrupted illumination by electric light	30	good	3	0.5	610	12.5	shrivelled	2	0.9	460	11	good	1.5	0.8	550	14
Potat. hanging horizontally. Electric light at night and direct sunlight during the day	30	somewhat shrivelled	4	0.6	625	13.5	soft	2	0.9	250	5	soft	2	0.7	620	15.5
Potat. hanging horizontally. Electric light at night and diffuse sunlight during the day	30	somewhat shrivelled	2	0.4	630	16										
Potat. hanging horizontally. Electric light at night and direct sunlight during the day	21	somewhat shrivelled	4	0.4	600	15	soft	1.5	1.0	400	11	soft	0.2	0.9	615	16.5
Control potatoes	—	good	2	0.5	650	11	soft	1	1.0	525	10	soft	1.5	0.8	600	12

The relative air humidity in the illuminated room varied between 84 and 95%, maximum temperature ranged between 18 and 20°C. Only during two days did the temperature rise to 21 and even 21.5°C. The experiments began on January 17th.

Two electric lamps were used for illumination: one of 300 watts at a distance of 50 cm. above the tubers, the other of 200 watts below them. The potatoes were repeatedly turned over on the threads throughout the period of the experiment. In this way all the buds were allotted a more or less equal amount of light. When the buds sprouted, pronounced differences between those potatoes which had been treated uninterruptedly with electric light and those which had received natural illumination during the day and electric illumination during the night became manifest, as the adjoined photographs show.

The potatoes were planted on February 18th and 19th in the field in two series, 8 plants in each plot. The potatoes of the control plots were germinated in the usual manner.

As shown in Table II, the condition of the potatoes at the time of planting was good in the majority of cases. The sprouting buds were short and thick. There seems to be a tendency towards a higher number of sprouting buds in the vernalized tubers. This can be explained by the fact that the vernalized potatoes enjoyed more uniform illumination. As seen in Table II, no differences distinguish the vernalized from the unvernalized plants during growth in the field. In every respect the growth consequences of the various treatments are more or less equal. No differences in the time of beginning of blossoming and maturation were observed. As to yield, there are indeed certain differences, but these are so small that they do not justify any conclusions as to the superiority of one treatment over the other. The same is true in respect of the number of tubers per hill.

SUMMARY

During two successive plantation periods, in autumn and in spring, none of the potato varieties tested was influenced by vernalization. The period of vegetation could not be shortened nor could the yield be raised. It is as yet impossible to say whether the result obtained is a consequence of the special climatic conditions of Palestine. It seems possible that in the case of the varieties tested the factors producing vernalization are not those chosen in our experiments.

REFERENCES

(1) EICHFELD, (Of the Polar Division at the Institute of Plant Industry at Hibiny), Struggle for the Far North, Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad, 1933, p. 46. — (2) FOKEEV and VYROW, The Wider Utilization of Experience in the Central Volga Region, Soc. Zemledelie, No. 247, 1934. — (3) FOKEEV and VYROW, Results of Vernalized Sowings in the Kuibyzew Region in 1934, Soc. Zern. Khoz., No. 2, 110-17, 1935. — (4) VAN HOEK, Eenige Waarnemingen Omtrent Jarowisatie (Certain Observations on Vernalization), Landbouwk. Tijdschr. 46, 1934.

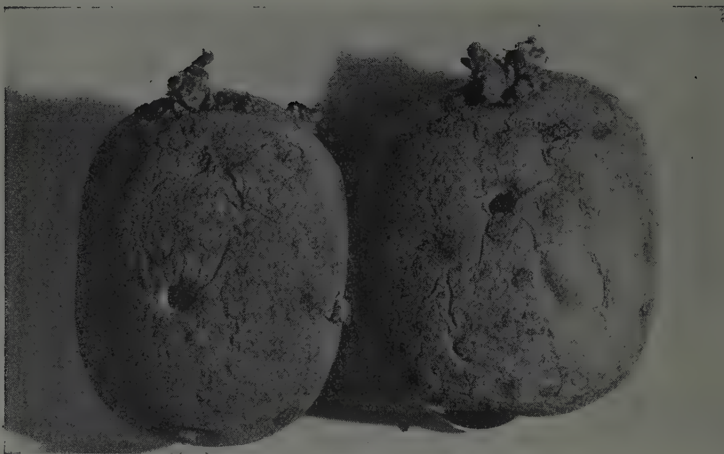


Fig. 1.

"Up to date" potatoes sprouting after 21 days' uninterrupted illumination with electrical light.

Fig. 2.

"Up to date" potatoes. No sprouts developed as yet after 21 days' illumination with natural sunlight during the day and electrical light at night.

J. PERLBERGER:

Rhizoctonia Bataticola (Taub.) Butler in Deciduous Fruit Nurseries in Palestine

From the Division of Plant Pathology of the J.A.P. Agricultural Experiment Station, Rehovot

Deciduous fruit-tree culture constitutes an important branch of Palestine's agriculture. Every year the area under deciduous fruit trees is increased. The demand for young trees increases, and the number of existing fruit-tree nurseries multiplies accordingly.

Being new in the country, this plantation branch still presents numerous difficulties of cultivation and care. The cultivator who enters it is continually surprised by various hitherto unknown developments of obscure nature causing more or less damage. The nurseries in particular are subject to the attack of a number of economically important diseases and suffer. In investigating these pathological features, it is important to remember that most of the trees in the local nurseries — such stone fruit trees as are grown from seeds in the country excepted — are imported from northern countries and are introduced, before they are budded, into the different and novel climatic and soil conditions of Palestine. In addition to new environmental conditions, the young fruit trees are also confronted with new disease-causing agents. Both factors acting together put a heavy strain upon the resistance of the trees.

In our survey of nursery diseases in Palestine, we came across a disease not previously known to occur on deciduous trees. This disease is of great economic importance, and may destroy as many as 50—60% of the trees in the nurseries. The examination showed that the fungus *Rhizoctonia bataticola* is found alone, or in association with other fungi, in the infected trees. All the varieties grown for stock in Palestine (apple, pear, quince, apricot, peach, almond, plum, mirobolan, cherry, and nut) fall victims to this disease.

The present paper is a preliminary report on our observations of the occurrence and pathology of the fungus *Rhizoctonia bataticola* in the deciduous fruit tree nurseries of Palestine during the last two years.

FORM AND SYMPTOMS OF THE DISEASE

Young trees infected with *Rhizoctonia bataticola* occur mainly in the summer months. The first symptoms in the nursery are the sudden wilting and blight of the leaves. After wilting, the leaves remain on the stem for a long time and are shed only after many weeks. If the infected treelings are uprooted, pronounced changes may be observed in the root collar and roots. Frequently, trees are found in which only the root collar is infected, the root system as a whole being healthy and free of any symptoms of disease. In such cases, a dark coloured girdle may be seen on the bark, 2—3 mm above the root collar, 2—3 mm above or below the ground (Fig. 1). The bark of the girdle is dark blackish brown. A smooth line marks off the infected girdle from the lower part of the main root. On the upper boundary, there is no sharp line of demarcation between the infected area and the other parts of the stem. Generally, the browning spreads progressively upwards until all the upper part of the tree has turned brown and wilted. If the bark at the transition from the brown to the healthy part of the root collar is whittled away, a brownish black line corresponding in position to the line between the infected and uninfected parts of the wood may be distinguished (Fig. 2). This line is well marked and sharply delimits the two zones in the wood. Frequently, the main root below the black line in the wood and the brown ring gives rise to new roots and grows new sprouts. But in most cases the rot extends downwards, and attacks the entire root system, the secondary roots and the root hairs. All or some of them turn dark brown, soften, and disintegrate. The epidermis peels off in small thin strips, resembling brown paper (Fig. 3). The bark fibres separate into single threads or bundles of threads, and the wood is bared. Numerous small black dots appear on the wood at this stage of the rot. These are sclerotia of the fungus.

If the infected trees are allowed to remain in the soil for several weeks, the part of the tree above the soil rots and disintegrates. Its bark and wood are then found to be covered with thousands of sclerotia (Fig. 4).

PATHOLOGICAL HISTOLOGY

In the first stage of the disease, when the brown girdle appears on the root collar, the bark and wood tissue of the infected parts, but particularly the cambium and soft bark cells, contain a straight elongated mycelium. A thicker mycelium, consisting of short, round, thick walled, dark brown-green cells, also occurs. This mycelium shows all the characteristics of *Rhizoctonia bataticola,* and occurs in all types of bark and wood cells. In the bark, its development is greatest within the cambial tissues; and in the wood, it spreads first through the cells of the medullary rays of the xylem (Fig. 5). In these cells, the mycelium multiplies characteristically and rapidly, dividing lengthwise and transversely, and forming in every cell tiny sclerotia, shaped like the host cells. These sclerotia later unite into larger ones, that appear to the naked eye as black dots in the wood or bark (Fig. 4).

MYCOLOGICAL EXAMINATIONS

During 1935 and 1936, cultures were taken of hundreds of fruit tree saplings which showed the symptoms of the disease described above. All cultures were made on potato agar. Generally, *Rhizoctonia bataticola* developed in almost pure culture. At times, *Fusarium* and more rarely also other fungi were found in addition to *Rhizoctonia bataticola.*

Table 1 contains a list of cultures which were made during summer 1936, from deciduous fruit-trees. Out of 231 cultures, 78 resulted pure *Rhizoctonia bataticola,* 30 yielded *Rhizoctonia bataticola* in association with another fungus, and 123 were negative. It may be noted that in most cases in which other fungi were found instead of *Rhizoctonia bataticola,* the disease symptoms were different. In addition to trees from which cultures were taken, hundreds of saplings cultivated in nurseries in all parts of the country were examined with the aid of a magnifying glass. In many of them, sclerotia of *Rhizoctonia bataticola* were found in the wood and bark. In most cases, all parts of the root collar, root and stem were penetrated by *Rhizoctonia bataticola* mycelium.

The occurrence of this fungus in young deciduous fruit trees was formerly unknown. Neither has it been found as yet on mature deciduous trees.

FUNGUS HISTORY

The fungus *Rhizoctonia bataticola* was discovered by SHAW (22) in 1912 in India, and erroneously identified as *Rh. solani.* In 1913, TAUBENHAUS (28) found this fungus as a cause of black rot of sweet potatoes in Delaware, and named it *Sclerotium bataticola.* For symptomologic reasons, SMALL (23, 24), who found the fungus in Ceylon, called it *Rh. lamellifera.* And in 1925, BRITON-JONES (2, 3) on the basis of a morphological comparison of the above mentioned varieties by BUTLER, named the fungus *Rh. bataticola.* In 1927, ASHBY (1) proved that *Rh. bataticola* was the imperfect form of the fungus *Macrophomina phaseoli.*

HAIGH (9) showed in 1930 that fungi known as *Rh. bataticola* are not a true systematic unit, and accordingly divided the known strains into 3 groups according to the size of the sclerotia. Group C includes strains the sclerotium diameter of which does not exceed 120 μ, group B those the sclerotium of which is less than 200 μ, and group A those the sclerotium diameter of which exceeds 200 μ. HAIGH (9) pointed out that so far only *Rh. bataticola* of group C have been shown to yield the pycnidia characteristic of *Macrophomina phaseoli.* As yet, proof of a relation between larger sclerotia and the pycnidia form is lacking.

Table 1.
Occurrence of *Rhizoctonia bataticola* in Nursery Stock of deciduous fruit trees

Name of the Stock	Number of cultured stocks	Number of stocks infected by: Rhizoctonia bataticola only	Rhizoctonia bataticola together with other fungi	Other fungi only
Apple Stocks:				
Douçain	88	42	6	40
Malus communis	14	3	6	5
dto. Khashabi (local apple)	25	7	—	18
Pyrus communis	39	6	4	29
Cydonia vulgaris	17	7	1	9
Prunus Amygdalus f. amara	22	4	4	14
Myrobolan	23	7	8	8
Prunus armeniaca (local apricot)	3	2	1	—
Total	231	78	30	123

HOPKINS (11) in 1933 reverted to the name *Rhizoctonia lamellifera* which was first formulated by SMALL (23) for HAIGH's "A" form (9), i.e. fungi the sclerotia of which are 200 μ or more in diameter, found to date only on woody plants.

THE GROUPS B AND A IN DECIDUOUS FRUIT TREE NURSERIES IN PALESTINE

The fungi occuring in the deciduous fruit treé nurseries in Palestine belong to group B according to HAIGH's classification. It should be mentioned however that the minimum size in our cultures was smaller than that indicated by HAIGH who defines

Table 2.

Size of sclerotia of *Rhizoctonia bataticola* isolated from young Palestinian fruit trees.

Name of the host	Number of the pure culture	Size of the sclerotia in μ
Douçain	676	50 — 170
	686	50 — 170
	689	50 — 170
	692	50 — 240
	709	50 — 170
	726	50 — 200
	733	40 — 130
	735	70 — 200
	767	200 — 550
Malus communis	763	50 — 170
Khashabi (local apple)	723	50 — 200
	734	50 — 200
	745	50 — 170
Pyrus communis	765	50 — 170
Cydonia vulgaris	759	50 — 170
Prunus Amygdalus	718	50 — 170
Prunus armeniaca	719	40 — 170
	761	50 — 170
Mazard	724	40 — 170
Mahaleb	690	50 — 170
Juglans nigra	721	50 — 170

group B as that possessing sclerotia of a diameter between 100 μ and 200 μ. In our cultures, we found in the same variety and culture sclerotia as small as 50 μ and larger than 200 μ in diameter. The most common size was between 140 and 150 μ. This observation requires further elucidation and is to be followed up in a separate investigation.

On only one occasion was a culture found, possessing large sclerotia, belonging, according to Haigh, to group A (sclerotia between 200 and 550 μ). According to Hopkins, this variety should be named *Rh. lamellifera*. This type was found only once, and for the first time in Palestine in the hills of Judea on an infested Douçain sapling, near Jerusalem. Table 2 contains measurements of sclerotia in pure cultures isolated from indicated varieties of deciduous fruit-tree saplings.

DISTRIBUTION OF THE FUNGUS

The fungus *Rh. bataticola* occurs in numerous tropical and a few sub-tropical countries. It was found in the Mediterranean region in Egypt in 1920 (2), in French Marocco in 1924 (15), in Palestine in 1929 (17, 18, 19,), in Cyprus in 1933 (16), and in Greece in 1935 (2). It was also found in Roumania once in 1933 (21). This last is the most northerly country in which the fungus has been found.

In Palestine, the fungus is very wide spread and occurs on a large number of herbaceous and woody plants. The C type was described by Reichert (17, 18), and by Reichert and Hellinger (19) as attacking annual plants. It is characteristic that it is of frequent occurrence in Palestine on summer crops but only rarely on winter crops, even if the plants involved, such as egg plants, tomatoes, etc., are cultivated in both the summer and winter seasons. In deciduous fruit tree nurseries as well, the fungus is most common in the summer months. An increased incidence marks the summer and autumn months whereas in spring the young trees suffer more from fungi such as *Sphaeropsis* sp., *Diplodia* sp., *Fusarium* sp., *Fomes* sp.

PATHOGENICITY OF *RHIZOCTONIA BATATICOLA*

As yet the problem as to whether *Rh. bataticola* is a parasite has not been solved. Small (25, 26, 27) and others believe it to be a parasite in the full sense of the word, and attribute great im-

portance to it as a causal agent of root and root-collar rot. Briton-Jones (4, 5), Gadd (7), Hansford (10) and others consider this fungus to be either a secondary agent of infection or a facultative parasite. The doubt arises out of the fact that few have been able to infect the host plant with the fungus and produce artificially the disease symptoms described. The failure was particularly complete in the case of woody plants and the infection experiments were successful only in the case of annual plants with fungi of type C. As regards the pathogenicity of *Rh. bataticola* for deciduous fruit-trees, it is still too early to venture an opinion as to whether *Rh. bataticola* type B is to be regarded as a parasite or not, since artificial infection experiments with this type have not as yet been carried out. These will be performed in future. Meanwhile certain field observations may be cited which seem to cast doubt on the infective power of this organism. Two facts must be emphasized:

1) The fungus appears on the trees only in the summer months, and only in this season is the mortality high among the deciduous fruit trees attacked by this fungus.

2) The epidemic summer mortality is largely restricted to the coastal region of Palestine where the method of cultivation is different from that in the hill region.

The fact that *Rh. bataticola* appears mainly in the summer months does not oppose the view that the fungus is a parasite. The whole behaviour resembles that of a fungus adapted to a warm climate. According to the work of Tompkins and Gardner (29), the optimal temperature of its development is 34°. On the other hand, however, the susceptible hosts, such as deciduous fruit trees, are plants of a cooler climate, the acclimatization of which in Palestine constitutes a special problem by itself. Most of the young trees are introduced into Palestine from northern Italy or France. It is not surprising, therefore, that the Palestinian climate and factors depending upon it hamper the development of the trees and weaken their resistance to diseases uncommon in the countries of origin. This is particularly the case in the hot summer months. Small (25) has already pointed out that the plants suffering particularly from attacks of this fungus in tropical countries are such as have been imported from more temperate regions. The high temperature of the atmosphere and the heating of the soil during the summer months are important factors inhibiting or accelerating vegetative growth. During the last summer, which was temperate

as far as temperature is concerned, the heating of the upper layers of the soil at Rehovoth was determined by the author; accordingly, the temperature of 4 layers of unirrigated light sandy soil, at depths of 3 cm, 18 cm, 33 cm and 48 cm respectively, were measured with the help of maximum—minimum thermometers. As table 3 shows, the monthly average of maximum temperature in the two middle layers did not exceed 34° in July, August and September, whereas in the upper layer the average monthly maximum temperature reached 54°. During the period of measurements, even absolute temperatures of 60° were occasionally found. If these figures are kept in mind, it will be clearly apparent how the root collar of deciduous fruit trees, placed as it is in the upper layer of the soil, can suffer physiological damage due to the high temperature. The character of this damage is obscure, but its influence becomes apparent in that the root collar turns light to dark brown. The green bark tissue, which during early stages of growth contains chlorophyll, turns partially brown in the first stages. This phenomenon resembles sunburn, which is generally restricted to the west side of the young tree. This side, subject to direct illumination by the sun's rays between 2 and 4 p.m., generally suffers, near the root collar. In definite cases of sunburn, no fungi are found in the plant tissue. When, however, a dark ring is observed about the root collar, most saplings on opening or culturing have proved to contain the fungus *Rh. bataticola*.

Table 3.

Monthly average of maximum and minimum temperatures of the soil at Rehovot (1936)

Month	Depth of measuring point:							
	3 cm		18 cm		33 cm		48 cm	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
July	50°C	22°C	33°C	29°C	31°C	28°C	29°C	28°C
August	54°	24°	34°	30°	30°	30°	30°	29°
September	53°	18°	32°	26°	30°	28°	30°	28°
October	42°	15°	27°	23°	21°	19°	26°	25°
November	30°	12°	22°	19°	26°	24°	22°	19°
December	17°	8°	15°	12°	12°	11°	13°	11°

Leach (13, 14) expressed the suspicion that in tea plants, as well, sunburn precedes the attack of *Rh. bataticola*. The external

similarity of symptoms does not in itself justify the conclusion that root collar girdling and sunburn of the trees which usually occurs only on one side, are identical. It is, however, very possible that the girdling is rather a result of soil overheating than of infection. The overheating markedly increases the susceptibility of the tissue to infection with the fungus. It is worth pointing out that in most cases of girdling, the main and secondary roots remain healthy at first, and of normal appearance. Often the main root grows new and young sprouts from beneath the dead girdle (Fig. 1, 2,) and only the part above degenerates, wilts, and dies. Frequently, however, the young sprouts and the roots that previously remained healthy, also die. The tissue of these parts contains the fungus *Rh. bataticola* in abundance.

In addition to this observation, the fact may be noted that the highest mortality among young trees occurs after budding. In the coastal region where plentiful watering in nurseries is the rule, a well developed tree is soon obtained. The growers generally bud the young fruit-trees towards the end of May or the beginning of June. After a number of days, the stocks are completely or partly lopped. In experiments carried out in a number of nurseries, wherein several rows of Douçain, Malus communis and others were left unbudded while other rows were budded, the mortality among the budded trees was high, while in the unbudded rows, no symptoms of the disease developed. All the dead trees showed either root collar rot alone or rot of the whole root system. In almost all cases of infection the mycelium of *Rh. bataticola* was found penetrating the tissue. This outstanding fact proves that the preparatory treatment and incisions involved in budding weakened the trees to a degree that they were unable to withstand the attack of the disease causing agents. No definite opinion is possible, since experimental proof is as yet lacking. But it is certain that topping of the stock interrupts transpiration suddenly, and that as a result the max. temperature in the soil reaches 55—60°. Preparations are being made by us to examine the temperature conditions in the body of the trees at different times. These measurements will be made in the coming summer. The above consideration which concerns a multitude of physiological functions, suggests that the problem of parasitism of *Rh. bataticola* is still without definite solution. As yet, only the pathogenicity of type B towards annuals has been experimentally proven. The proofs as regards woody plants are indefinite. On the

other hand, however, it may be noted that most investigators, and in particular BUTLER (6) and LEACH (13, 14) working in tropical countries, where *Rh. bataticola* is endemic, emphasize that tea plants are attacked especially after treatments involving cutting, heavy pruning, excessive thinning of leaves, etc. It seems likely that in these cases as well the treatment caused an increase in the temperature of the plants. It may be noted that as a result of the temperature increase the plant tissue and the enzymes contained in it, suffer damage. It is this damage which enables a fungus such as *Rh. bataticola* to penetrate into the woody tissue and to destroy it. Perhaps this observation offers the solution to the problem of parasitism of *Rh. bataticola* in general and in respect to woody plants in particular. It may even be possible to demonstrate by future experiments that plants damaged by heat are susceptible to attack by *Rh. bataticola.* This assumption is supported by the observation and experiments of KENDRICK (12) who showed that bean blight due to *Rh. bataticola* type C appeared in the fields only in years when the summer temperature exceeded 38°. Similar results were obtained by KENDRICK (12) in infection experiments on other bean varieties. During months when the temperature of infected soil exceeded 95°F, the infections were positive; and in months when the temperature was lower, the artificial infection of these varieties was negative. TOMPKINS and GARDNER (29) tested the pathogenic power of *Rh. bataticola* at different temperatures and found that type C was pathogenic to bean plants almost to the same degree at all temperatures, but that a slight increase of pathogenicity occurred between 34 and 37°. Types A and B, on the other hand were non-pathogenic. The maximum temperature tested was 40°. As we suppose, the critical temperature favouring infection is not that of incubation, but is undergone by the host before infection, causing physiological damage to its tissues.

EXPERIMENTS IN PREVENTION

In order to prevent the attack of *Rh. bataticola,* we attempted to disinfect the soil around the trees several days before budding and lopping of the stocks. An aqueous Ceresan solution 1:1000 was used for this purpose. Several rows were treated with 300 ccm of the above solution per tree. No satisfactory results were obtained in these experiments. After budding, the incidence of *Rh. bataticola* infection in the treated rows was no less than in the untreated.

Better results were received with trees treated by Bordeaux mixture 3—4% before the stock was cut back. The number of dead trees among those which had undergone this treatment was far below the number among the untreated trees.

Both experiments mentioned above are of a preliminary nature, and no final conclusion as to the advisability of using the disinfectants tried can as yet been drawn from them.

PRACTICAL CONCLUSIONS

It is obvious from the above that in order to prevent rot and blight of deciduous fruit-tree saplings, it is advisable:

a) to bud deciduous fruit-tree saplings in fall, and not in summer;

b) to treat the stems of the trees twice with Bordeaux mixture 3—4% before budding.

SUMMARY

A wilting disease of deciduous fruit trees caused by *Rhizoctonia bataticola* is described. The fungus attacks the young nursery stock at the root crown and sometimes spreads downwards to the roots and rootlets.

In general the fungi isolated from the diseased tissues were found to belong to Haigh's type B. Only in one case the presence of type A could be established.

Observations in the field resulted in the statement that *Rhizoctonia bataticola* attacks those parts of the trees which have been damaged by overheating in the uppermost layers of the soil.

Directions for the prevention of the disease are given.

LITERATURE CITED.

(1) ASHBY, S. F., Macrophomina phaseoli (Maubl) comb. nov., the pycnidial stage of Rhizoctonia bataticola (Taub.) Butler, Brit. Mycol. Soc. Trans. XII, 141-147, 1927. — (2) BRITON-JONES, H. R., Mycological work in Egypt during the period 1920-21. Min. of Agric. Egypt, Techn. & Sci. Service Bull. 49, 1925. — (3) BRITON-JONES, H. R., Mycological Notes: Rhizoctonia bataticola (Taub.) Butler. Trop. Agriculturist IV, 147-148, 1927.—(4) BRITON-JONES, H. R., Mycological Note: Macrophomina phaseoli (Maubl.) Ashby, Trop. Agriculturist IV, 194-195. 1927. — (5) BRITON-JONES, H. R., Comments to the above Note. Trop. Agriculturist V, 319-320, 1928. — (6) BUTLER, E. J., Report on some diseases of tea and tobacco in Nyassaland 1928. Dept. of Agric., Nyassaland, 1928. — (7) GADD, C. H., Rust diseases of economic crops. Trop. Agriculturist LXVIII, 363-370, 1927. — (8) GADD, C. H., Rhizoctonia bataticola and tea root disease. Trans. Brit. Mycol. Soc. XIV, 1-2, 91-109, 1929. — (9) HAIGH, J. C., Macrophomina phaseoli (Maubl.) Ashby, and Rhizoctonia bataticola (Taub.) Butler, Ann. of Royal Bot. Gardens, Peradeniya XI, 213-249, 1930. — (10) HANSFORD, C. G., Annual Report of the Gov. Mycol. Soc. Uganda, Dept. of Agr. 37-42, 1927. — (11) HOPKINS, J. C. F., Rhizoctonia lamellifera Small, a distinct species of the Rhizoctonia group of fungi. Proc. Rhodesia Scient. Assoc. XXXII, 65-79. — (12) KENDRICK, J. B., Seedling stem blight of field beans caused by Rhizoctonia bataticola and high temperatures. Phytopathology XXIII, 949-963, 1933. — (13) LEACH R., Report of Mycologist, Ann. Rept. of Agric. Nyassaland, 1931, 47-50. — (14) LEACH, R., Report of the Mycologist, Dept. of Agric. Nyassaland 1934, 24-26. — (15) MARESQUELLE, M., Sur un Sclérotium parasite du Mais. Bull. Path. Veg. et Ent. Agric. XI, 1924, 156. — (16) NATRAS, R. S., Annual Report of the Mycologist for 1933. Department of Agriculture, Cyprus. — (17) REICHERT, J., Note sur le sclérotium parasite du Mais. Rev. Path. Vég. et Ent. Agric. XVI, 8, 230-234, 1929. — (18) REICHERT, J., Palestine root disease caused by Rhizoctonia bataticola. Intern. Bull. of Plant Protect. IV, 17, 1920. — (19) REICHERT, J. & HELLINGER, E., A Blight of Beans in Pälestine, "Yedeoth" II, 1-2, 1929. — (20) SAREJANNI, J. A., et CORTZAS, C. B., Note sur la parasitisme du Macrophomina phaseoli (Maubl) Ashby, Annales de l'Institut phytopathologique Benaki 1935, p. 38. — (21) SAVULESCU, F., & RAYSS, F., Dry rot of Maize in Roumania. Ann. Inst. Rech. Agr. de Roum. V, 3-112, 1933. — (22) SHAW, F. J. F.,The morphology and parasitism of Rhizoctonia. Mem. Dept. Agric. India. Bot. Ser. IV, 1912. — (23) SMALL, W., A Rhizoctonia causing root disease in Uganda. Trans. Brit. Mycol. Soc. IX, 152-166, 1924. — (24) SMALL, W., On the identity of Rhizoctonia lamellifera and Sclerotium bataticola. Trans. Brit. Mycol. Soc. X, 287-302, 1926. — (25) Report of the Mycol. Uganda Dept. of Agriculture, p. 23, 1925. — (26) SMALL, W., Recent work on root disease of economic and other plants in Ceylon. Trop. Agriculturist LXVIII. 201-222, 1927. — (27) SMALL W., On Rh. bataticola (Taub.) Butler as a cause of root disease in the tropics. Trans. Brit. Mycol. Soc. XIII, 40-68, 1928. — (28) TAUBENHAUS, J. J., The black rots of the sweet potato. Phytopathology III, 1913, 161-164. — (29) TOMPKINS C. M., and GARDNER, M. W., Relation of temperature to infection of bean and cowpea seedlings by Rhizoctonia bataticola. Hilgardia IX, No. 4, 1935.

Fig. 1.

Apple stock attacked by *Rhizoctonia bataticola* (Taub.) Butl. Upper part of the diseased bark shrivelled, sprouts developing from below the diseased area.

Fig. 2.

The same stock cut longitudinally. Note the discoloured parts of the wood and the dark line delimiting the infected and uninfected areas.

Fig. 3.

Dead Douçain stock. Roots and crown in the last stage of infection with *Rhizoctonia bataticola.* Photographs by J. Perlberger

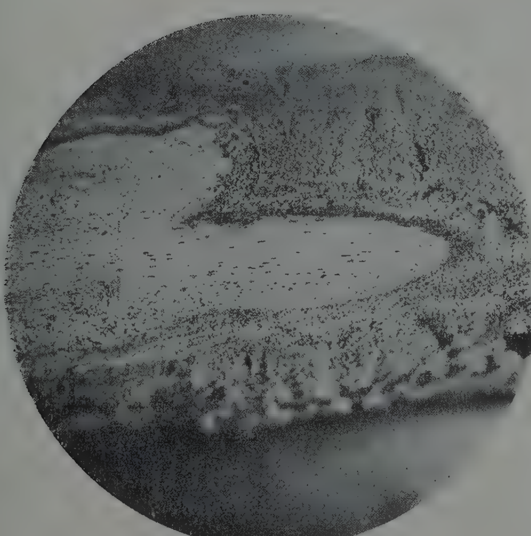


Fig. 4.

Malus communis attacked by *Rhizoctonia bataticola* from a nursery near Jerusalem (25.1.1935) Black dots representing the sclerotia. Phot. J. Perlberger

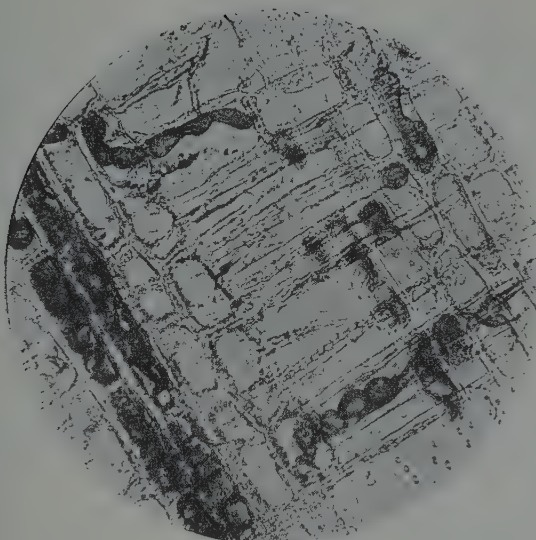


Fig. 5.

Longitudinal section through the xylem of an apple nursery tree with mycelia of *Rhizoctonia bataticola* in the xylem parenchyma and the medullary rays. Beginning of sclerotia formation. Phot. J. Perlberger

אף אחד מזני תפוחי־האדמה שהועמדו לנסיון על ידינו, לא הושפע ע״י הטפולים הנ״ל — לא מצד קיצורה של תקופת הגידול ולא מצד העלאת היבול. כך היו התוצאות בשתי עונות הזריעה הסתיו והאביב. אין להכריע בודאות, במה יש לתלות את התוצאות השליליות של נסיונותינו, אולי תנאי אקלימה המיוחדים של ארץ־ישראל אינם מאפשרים את הקיוט בכלל או אולי מחייבים הם לגבי הזנים שנבחנו על־ידינו, דרכי השפעה שונות מאלה שהשתמשנו בהן בנסיונותינו.

י. פרלברגר

Rhizoctonia bataticola במשתלות עצי פרי נשירים בא״י

(חוב׳ ג׳ עמ׳ 37־48)

המאמר מתאר את כמישת שתיליהם של עצי־פרי משירים, הבאה מחמת הפטרייה Rhizoctonia bataticola, שנטפלה לשתילים בצווארי שרשיהם או בשרשיהם עצמם.

הפטרייה האמורה הוגדרה כבת הקבוצה B שבחלוקת Haigh. רק פעם אחת נמצאה גם פטרייה השייכת לקבוצה A.

הובאו הסתכלויות־שדה המוכיחות, שה־Rh. b. פגיעתה מצויה ברקמתם של שתילים, שחלקים ידועים מהם ניזוקו נזק פיסיולוגי מן החום הגבוה של שכבות־הקרקע העליונות.

צויינו דרכי־פעולה לשמירה מפני המחלה.

(חמסין חם) ובימי קדים (שרקיה קרה). שתי הופעות אלו דומות בתהליך היומי ובגודל ההתאדות אף כי התנאים האקלימיים שבהן שונים לגמרי.

בשרב, הטמפרטירה גבוהה והלחות היחסית שבאויר ירודה ביותר בעוד שהרוח ממזרח או ממזרח-דרום הלשה מאד ברוב המקרים.

בקדים, הטרפרטורה נמוכה מאד, הלחות היחסית ירודה כמו בשרב. אבל הרוח חזקה עפי״ר ולפעמים חזקה מאד.

ההתאדות בימי קדים קשים אינה קטנה מאשר בימי שרב.

בהתחשב עם הרוח החזקה הקרה והיבשה בימי קדים, מתעוררת השאלה על הצורך במשברי רוח טובים בעבר המזרחי של מטעים רגישים. באזורים ידועים כגון בעמק הירדן הצפוני ובעמק יזרעאל אין הנזקים הנגרמים ע״י הקדים בחורף קטנים בכמותם כלל מהנזקים הנגרמים שם ע״י הרוח המערבית החזקה בשעות אחה״צ של ימי הקיץ.

ש. הורביץ

נסיונות בקיוט של תפוחי־אדמה

(חוב׳ ג׳ עמ׳ 27־36)

השתמשו בשיטת הקיוט*) של תפוחי־אדמה כפי שעובדה ע״י החוקרים הרוסים השיטה מבוססת על ההשפעה שאור בלתי פוסק בפני טמפרטורה קבועה משפיע על פקעות הצמח. לנסיון הועמדו בעונת הסתיו 4 זנים: „אפ־טו־דיט״, „מג׳סטיק״, „פריגולד״ ו„אדלרגיס״ ובאביב 6 זנים: „אפ־טו־דיט״, „אדלרגיס״ „קונ סורגים״ „שנירגיס״, „וקארגיס״, „פריבוטה״.

בנסיון שבעונת הסתיו הושחלו התפוחים על חוט מאוזן והוארו בלילה באור חשמל של מנורה בת 200 וואט וביום באור הטבעי של השמש, כך במשך 24 יום. התפוחים היו נתונים במרחק של 40 ס״מ ממנורת החשמל.

בנסיונות שבעונת האביב היו התפוחים תלויים על חוט, קצתם במצב מאונך וקצתם במאוזן. החלק האחד של התפוחים הואר באור חשמלי מתמיד, החלק השני באור חשמלי בלילה וטבעי ביום, והחלק השלישי באור חשמלי בלילה ובאור־שמש מפוזר ביום. ברוב הנסיונות טפול זה נמשך 30 יום, ובחלקם רק 21 יום. להארה שמשו הפעם שתי מנורות חשמל, אחת בת 300 וואט במרחק 30 ס״מ מן התפוחים, והשניה בת 200 וואט, במרחק של 40 ס״מ מהם. פעמים אחדות הוסבו התפוחים על חוטים, כך שכל העיניים בהם קבלו כמויות שוות של אור בערך. לחות האויר בחדר המואר היתה נתונה בגבולות של 84% ו־95%; הטמפרטורה בין 18% ל־20% מעלות צלסיוס.

*) קיוט yarovizaciya, vernalization

מעוביו של הגזע, לא היה בהם כדי להנביל את הנוף נבילה מתמדת. נסיונות כיוצא באלה, שנעשו בלימון המתוק, הראו, שאף הוא יכול לעמוד בחיתוכים, צדדיים או מקיפים, שנטלו 58־70 אחוז מעובי הגזע. גם הלימון החמוץ ואתרוג־הבר נבדקו והראו כשרון ניכר של קיום בפני חיתוכי גזע עמוקים כנ"ל.

נעשו גם נסיונות בשני חיתוכים צדדיים זה למעלה מזה, הבוקעים אל הגזע בכיוונים הפוכים, — כך, שכל קו וורטיקלי העולה משורשי העץ לצמרתו נחתך פעם אחת לכל־הפחות. גם כאן לא נפסקה חיותם של העצים, הם משכו את זרמי מימיהם בעקיפין.

הוכח, שהחלק המרכזי של גזעי עצי־ההדר, לפחות של הצעירים בהם (העצים שנבדקו היו בני 4־5 שנים), מצטיין בכשרון מעולה להדליית מים.

ד. אשבל

מדת ההתאדות בארץ-ישראל *)

(חוב׳ ג׳ עמ׳ 8־26)

מדידות ההתאדות הנתנות בחבור זה הן במילימטרים עפ"י צנור פיטש בתוך סוכה מטאורולוגית. מספרים אלה אינם שוים למספרי ההתאדות משטחי מים, מן האדמה או מן הצמחים, אלא הם נותנים מושג פיסיקלי על גודל ההתאדות האפשרית בתנאים אקלימיים כפי שאנו מודדים. ערכם הוא בעיקר בלמור התהליך השנתי והיומי של גודל ההתאדות באזורים השונים של ארץ ישראל: בחוף הים, בנגב, בעמק יזרעאל, באזור ההרים ובעמק הירדן הצפוני והדרומי.

מתוך השואת המספרים מתקבל כי ההתאדות הקטנה ביותר במשך השנה היא בחוף הים התיכון (עזה, תל-אביב, חיפה) ובאזור החולה, גדולה מזו היא ההתאדות במקומות המרוחקים מן הים כגון עמק יזרעאל ובאזור ההר. במדרגה יותר גבוהה עומדת ההתאדות בנגב ובעמק הירדן. אלו היתה ההתאדות חפשית ולפי המדות הפיסיקליות כי אז היתה מגיעה במשך השנה למספרים הנתונים בטבלא 1 ובטבלא 2. בהשואה לכמות הגשמים (אף היא במילימטרים) היה משק המים בקרקע ובעולם הצומח צריך להמצא בגרעון תמידי עצום. טבלא זו מלמדת אותנו:

א) כי ההתאדות בתור גורם בעולם הצומח צריכה להלקח בחשבון רק בתקופת הגדול ולא בסכום השנתי. ב) יש להתחשב בתנאי ההתאדות והלחות שבאויר לפי התהליך היומי (בשעות היום ובשעות הלילה).

ג) הגבת הצמחים נגד ההתאדות במצבי אקלים שונים, היא אנדיבידו־אלית ושונה בכל מקרה. הופעה בעלת ערך מיוחד היא ההתאדות בימי שרב

---

*) העריכה הלשונית ע"י המחבר.

נאמדו גם הכמויות ההחלטיות של הצמחים בשדה וניתנה הערכה אומדנית של הנזקים הבאים מן העשבים השונים, — של צורות הנזקים ודרגותיהם השונות.

הפרסום פרלימינרי הוא.

ה. ר. אופנהיימר

הערות לשני מאמרים בקורתיים, המבקשים לפסול שיטות— מדידה המקובלות בפיסיולוגיה של הצמח

(חוב׳ ב׳ עמ׳ 84־93)

הגב׳ א. ארנסט הטילה בספק את ערכן של השיטות למדידת כוח־היניקה של התא, שהומצאו ע״י אורשפרונג ובלום, וכן את ערך השיטה הפלאסמוליטית של דה־וריס. בחקירותיו הקודמות הוכיח גם המחבר, ששיטת אורשפרונג מפוקפקת היא, אבל הוכחתו נתמכה בראיות השונות משל בקורתה של ארנסט. בקורת זו אין לה רגלים, מפני שמוטעות המדידות של שטח התאים, המונחות ביסודה. אי־אפשר שהיו תאי־הרקמות, שנמדדו ע״י ארנסט, מצויינים בכשרון מופלג כל־כך של התפשטות והתכווצות, כפי דבריה.

בנוגע לשיטה הפלאסמוליטית של דה־וריס יש להדגיש, שהיא אחת השיטות הנאמנות ביותר שבפיסיולוגיה של הצמח, לפחות מבחינת הביסוס התיאוריטי. ארנסט מחווה את הסברה המפתיעה, שהשיטה הפלאסמוליטית של דה־וריס, המיוסדת על שווי־המשקל הפלאסמוליטי, מופרכת מעיקרה, מפני שנטולה האפשרות (— כך דעתה של ארנסט) להכריע, אם התהליך, המביא לידי שווי־המשקל ההוא בין התמיסה הפלאסמוליטית ומוהל־התא, כבר הגיע בשעת התצפייה לגמר סיומו. אותה סברה קשורה בשניה התמוהה עוד ממנה, והיא — ששיטת דה־וריס אינה בת סמך תיאורטי, אם כל הריכוזים של התמיסה הפלאס־מוליטית, הגבוהים מריכוז־הגבול, אין כולם כאחד מחוללים את שווי־המשקל הפלאסמוליטי במשך זמן קצר ש ו ו ה.

המחבר סותר את הסברות האמורות.

טמירה אלעזרי־וולקני

כיצד משפיעה על חיות הנוף של עצי־ההדר הפסקה חלקית של זרם ההתנדפות בעץ, שנעשתה על ידי קיצוץ שרשים וחיתוכים בגזע

(חוב׳ ב׳ עמ׳ 94־96)

עצי־הדר שונים, שקוצצו שרשיהם כדי 50־70 אחוז, לא גרם הדבר לנופם אלא כמישה קלה. עץ התפו״ז בלדי, שגזעו נחתך מצד אחד כדי 54% מעוביו, לא הראה לקוי כלשהו במצבו. אף חיתוכים בצורת טבעת, שתפסו 55־69 אחוז

אלה של דגנרציה מצויים בתאי־המשמר של עלים לבנים צעירים. העלים המזקינים תאיהם גוועים והולכים ואין למצוא בהם פלאסטידים כלל.

בעלים הנקודים נקודות לבנות נמצאו צורות ענקיות של כלורופלאסטים ירוקים; הללו מזדמנות על גבולותיהן של הרקמות הלבנה והירוקה. כאילו הדגנרציה השלמה של הכלורופלאסטים נתעכבה כאן בהשפעתם של התאים הירוקים. בצורות הללו יש לראות כעין צורות־מעבר בין הכלורופלאסט הנורמלי לכלורופלאסט החולה של המחוז הלבן.

בתאי הפיוניות נצפו מקרים, שהיה התא האחד חי ובן־זוגו מת, אבל מעולם לא נגלה המקרה, שאחד התאים הללו נתון בדרגת־דגנרציה שונה משל בן־זוגו.

חקירת התפתחותם של הכלורופלאסטים בזמן, שהעלה שרוי עדיין במצב מריסטמאטי, הראתה, שתהליך הדגנרציה מתחיל בהקדם רב, כשאורך העלה עוד לא הגיע אף לעשירית המילימטר. במשך התפתחותו של העלה מופיעות פיוניות, שתאי־משמרן גדושים עמילן, — דבר שהמחקר הקודם לא העלה אותו.

הערך האוסמוטי של התאים הירוקים עולה על של הלבנים. פלאסמוליסיס ע״י תמיסת סוכר ומלחת־אשלג כיווץ את הפלאסטידים של התאים הלבנים כיווץ ניכר וצמצם את הוואקואולות שבהם. תופעה זו לא נראתה בפלאסטידים של עלים בריאים. הדיפלאסמוליסיס ע״י שתנן חוזר ומרווח את הפלאסטידים הבלתי־נורמליים מחמת חדירותם כלפי החומר הנ״ל.

החקירה מראה, שאפשר להבדיל בין טפוסים שונים של ווריגציה על סמך ההפרשים הציטולוגיים והפיסיולוגיים המתגלים בהתפתחותם. יש תקוה, שהאנליסה של התפתחות הכלורופלאסטים תתן בעתיד את האפשרות להבדיל גם בין טיפוסים של ווריגציה, השונים מן הבחינה הגינטית.

מ. נאדל

על העשבים הרעים שבאזור יפו

(חוב׳ ב׳ עמ׳ 63־83)

נערך מפקד סיסטמטי ופנולוגי של צמחי האדמות הקלות בתחומי תחנת הנסיון שברחובות. הסתכלות במשך שנתים העלתה 136 צמחים בני 33 משפחות.

באקלימה של א״י, המחלק את השנה לעונות של ימות־החמה ושל ימות־הגשמים, מצויים עשבי חורף מיוחדים. בין צמחי־הקיץ מרובים גידולי המדבר. הצומח החורפי טיפוסי הוא לאזורי הים התיכון ולערבות המזרח הקרוב.

טבלה 1 מפרטת את שמות הצמחים שנמצאו ע״י המחברת ומציינת את זמן צמיחתם על אדמת רחובות וכן את האזורים הפיטוגיאוגרפיים של התפשטותם בעולם. מכלל הצמחים נבררו העשבים הרעים, המסוכנים לחקלאות ביותר. הציור 3 מציג את השפע היחסי של עשבים אלה לפי חדשי השנה.

התאים החיצוניות של גושי הקאלוס המתנגשים. המקומות בקאלוס, שקרני הליבה עוברות בהם, שם, בדרך כלל, אין פסים של גומי־מכה מתהווים.

6) הקאלוס שמתהווה בתחילה אינו רקמת־ארעי שסופה להה‏רס ולעבור, אלא הוא ניצור*) והולך דרך בידול פנימי ונהיה לרקמת־קבע.

7) תהליך הבידול מעייץ מעט־מעט את הקאלוס כולו ואינו משייר ממנו אלא לוח קטן מתחת לפקע הטלאי. לוח זה, — „בסיס הליבה", — הוא הוא המהווה את נקודת־המוצא לגליל־הליבה של השלוחה.

8) הקמביום המחבר שבין כנה לרכב, תחילת יצירתו מן הקאמביום של גפי־הקליפה המדולדלות. הוא פושט ועובר על גבי הקאלוס ומתלכד עם הקאמביום של הטלאי על שפת הטלאי ממש.

9) חקירה משווה של האיחויים בהרכבות שעל הלימון המתוק ושעל החושחש לא העלתה שום הבדלים פרינציפיוניים ביחס למהלך האנטומי.

10) כדי שיעלה יפה איחוי העין בעצי־ההדר, יש לדייק בהרכבה שיהיה בה טלאי־העין גדול ככל האפשר ושתיעשה „בלי עצה". במקום שאין ברירה ומן ההכרח להרכיב „עם עצה", יש לחתך את טלאי־העין חתוך דק ככל־האפשר. תהליך האחוי מהיר ומאושש אצל ההרכבה האביבית יותר מאצל הסתווית.

מ י כ א ל א ב ן ־ א ר י (וואלטר שווארץ)

לפיסיולוגיה של התפתחות הבורד (וואריגציה) בסילאגינילה

(חוב' ב' עמ. 47־62)

מחקר קודם של המחבר טיפל במקרה, שמשני תאי־המשמר של הפיוניות הכיל האחד כלורופלאסטים נורמליים, ירוקים, והשני — לבנים. הוכח, שהמינים השונים שניהם התפתחו ועלו מתוך כלורופלאסט א ח ד של תא־האם. ובכן החזיון שם היה תולדה של תנאים חיצוניים. המחקר הנוכחי עוסק בתופעה שאינה מושפעת ע"י גורמים חיצוניים — המקרה של Selaginella Martensii fol. albo - maculatis. חלוקת העלים המגוונים, — הירוקים, הלבנים והנקודים, — על גבי הענפים, כמו חלוקתם של טלאי הצבע, — הלבנים והירוקים, — על פני העלה האחד, כזו כך זו אינן מראות שום סימנים של סדר קצוב. במקומות מרובים יש שנויי־צבע בין תאים הסמוכים זה לזה. תאי האפידרמיס הרגילים של העלים הלבנים, פלאסטידיהם נתונים בדרגות שונות של שנוי־צורה פאתולוגי. אלה שבקצות העלים נפוחים הם ומראים וואקואולות. הפלאסטידים שבחלקו התחתון של העלה, בהם אין הדגנרציה לובשת צורה וואקואולית. כאן נפלגות בתוך הכלורופלאסטים הפאסות השונות (המוצקת והנוזלית) של הסטרומה הפלאסמטית ונבדלות טיפות פלאסמטיות רוויות כלורופיל. יש שתוכן הכלורופלאסט מיטשטש לגמרי, כדי כך, שאך בקושי אפשר להבחין את תחומיו הראשונים (ר' הטבלה בעמ' 50). טיפוסים

*) ניצור – לובש צורה, מתפתח (נפעל של „צור").

ו׳

ק. מנדל

האנטומיה וההיסטולוגיה של האיחוי בהרכבת העין שבעצי־ההדר

(חוב׳ ב׳ עמ׳ 13־46)

נבדק מהלכו של החיבור הגידולי בהרכבות ההדר. הבדיקות נעשו קודם־כל לגבי ההרכבות הסתוויות „בלי עץ" של תפו"ז השמוטי על הלימון המתוק.

1) החיבור הגידולי של ההרכבות הסתוויות הראה מהלך־שבזמן זה:

ראשית פילוגם של התאים	לאחר	20	שעות	בערך
גשרי־הקאלוס הראשונים	„	5	ימים	„
תחילתם של תהליכי הבידול*)				
א) בקאלוס של גפי־הקליפה**)	„	10	„	„
ב) בקאלוס של הטלאי	„	15	„	„
בצבוץ ראשון של טראכיאידות בקאלוס				
א) של גפי־הקליפה	„	15	„	„
ב) של הטלאי	„	20	„	„
גמר עיוצו***) של הקאלוס				
א) אצל גפי־הקליפה	„	25־30	„	„
ב) אצל הטלאי	„	30־45	„	„
בצבוץ ראשון של שכבות מריסטמאטיות				
בקאלוס שבין הטלאי לגפי־הקליפה	„	15	„	„
גמר יצירתו של הקאמביום המחבר	„	25	„	„

2) מהלך החזיונות המנויים ב־1) מהיר אצל ההרכבות האביביות יותר מאצל הסתוויות.

3) יצירת הקאלוס מתחילה כמעט בזמן אחד בכל הרקמות שמסביב לפצע. היא נמרצה ביותר על גבי העצה של הכנה, נמרצה פחות על גף־הקליפה המדולדלת ונרפית ביותר מתחת לטלאי. מבין אזורי־הפצע השונים יצירת הקאלוס מרובה בזוית של הגפים המדולדלות ומועטה מתחת לפקע הטלאי. הקצב המאוטט של כל התהליכים החדשניים מתחת לטלאי, סבתו, בלי ספק, האספקה הלקויה של מים וחמרי־מזון בזמן הראשון לאחר הניתוח.

4) מיני ההדר, שנבדקו על ידינו, אין עצתם המבוגרת וליבתם בנות־התחדשות. לפיכך, ההרכבות „עם עצה" מצריכות חיתוך דק מאד של הטלאי, אם רצוננו שצד־היפוכו של זה יעלה קאלוס כולו.

5) גומי־המכה אינו גדל על פני השטח של פצע־ההרכבה או של הקאלוס גידול ראשוני. בצורה של פסים מפורדים הוא צץ ועולה רק לאחר זמן ממושך, תחת לחצו של הקאלוס המתערה ומתהדק, — עולה מתוך הריסתן של שכבות־

---

*) בידול differentiation

**) גפי־הקליפה Rindenlappen, bark flaps

***) עיוץ Verholzung, lignification

ההגנה על העצים מפני מחלות פאראזיטיות הוצעדה צעד חשוב קדימה, כשנטל המחבר לצרכיה תרכבות שאינן מתמזגות במים, המשפיעות באדיהן השפעה מרעילה על המנגנון הפיסי־חימי של נשימת התאים. רעלים המחבלים את הנשימה, כגון מונוכלור־נאפתאלין, פארא־די־כלור־בנזול וכלור־קסילול, הובאו בתערובת עם פלואוריד של נתרן וניתנו בצורת משחה. הרעלים הנ"ל בצורה נוזלית, הומצא להם ע"י המחבר גם תשמיש טכני רב־ערך — של שימור קרשים, קורות וכו׳ מפני התקפות של פטריות חבלניות. הרעלים מן הסוג האמור, שאינם מתמזגים במים ולפיכך אינם נסחפים בהם, משהים את פעולתם בתפטירי הפטריות, שנפגעו על ידם, ונבלעים אט־אט בתוכם. ההתפשטות הזוחלת של הרעלים נותנת לרקמות העץ הבריאות שהות די צורך יצירה של שכבות־הגנה בפניהם.

הנסיונות הראו, שהעצים מסוגלים לקלוט כמויות גדולות של הרעלים הנ"ל בלי נזק ניכר לבריאותם. פאלק מתאר מקרה, שבעזרת רעלי־החנק הוארכו חייה של Tilia זקנה מאד. כן הוא מביא מקרים, ששיטת הריפוי החדשה הביאה תקנה לעצים, שהיו נגועי פטריות בגזעיהם, בצוארי שרשיהם או בקליפתם.

בסוף דבריו מסביר המחבר את „החוק של מחוזות־הנגעים", שגילהו בעצים הלקויים ע"י Basidiomycetes. התפטיר כובש לו בתוך העץ מחוז המסוים בגבוליו, כובשו להנאת עצמו בלבד ושומר על הנחלה שלא תפרוץ לתוכה פטריה אחרת. החזיון הזה איפשר בידודן של תרבויות טהורות מתוך עצה נגועה. אף עלה בידי המחבר לבדד פטריות חלדון Peridermium Pini, שגידלן אחר־כך בהצלחה על תמצית של שכר. מעולם עד־לכן לא הצליח גידולן של פטריות אלה על קרקע־מזין מלאכותי.

פ. ש. בודנהיימר

תורות האוכלוסין של עולם־החי ושל עולם־הצומח בהשוואתן זו לזו

(חוב׳ ב׳ ע׳מ 7־12)

השואה של תורת־האוכלוסין אשר לעולם־החי ושל זו שלעולם הצומח מראה שוויון גמור בעיקרונות. מצד אחד האקלים, המזון, הקרקע, צפיפות האוכלוסין, אויבים ומחלות, — הגורמים החיצוניים, — ומצד שני יסוד־התגובה התורשתי, — הגורם הפנימי, — כל אלה יחד קובעים לכל מין את כמות האוכלוסין ואת תנודותיה של כמות זו. ביחס לשאר הדברים מצויים הבדלים. הקרקע, למשל, חשיבותה אצל הצמחים גדולה הרבה מאצל החיות. הצמחים שאינם נתונים לקרינת השמש, אורך זמן התפתחותם תלוי בטמפרטורה תלות היפרבולית (המכפלה של שני הגדלים הללו אינה משתנית). את דיאגרמת התמותה אנו מוצאים גם בעולם הצומח. הצמחים אף הם תמותתם מרובה ביותר בתקופת חייהם הראשונה, תקופת הנביטה, מרובה כדי כך, שרק אחוז קטן מאד מתקדם בהתפתחותו ונכנס למלחמת הקיום.

להשמדת הכשות יש לאסוף בחורף את פירותיה ולהסיר את כל גבעוליה מעל ענפי הפונדקים. חשובה גם ההשגחה, שלא ינבטו זרעי הטפיל בסמוך לצמחים העלולים להפגע על ידו.

ה. ר. אופנהיימר

הוגו דה־וורים כבוטנאי־פיסיולוג

(חוב׳ א׳, עמ׳ 51־69)

המאמר מסכם את חקירותיו של דה־וריס בפיסיולוגיה של הצמח, שפורסמו בין 1870 ל־1890. הסיכום מבליט את העובדה, שהמלומד הנ״ל הניח יסודותיהם של הרבה ענפים בפיסיולוגיה הבוטנית ורוב תגליותיו נתאשרו ע״י המחקר הבא, והן שרירות וקיימות עד היום.

ר. פאלק

רעלי־חנק, שאינם מתמסמסים במים—כאמצעי לרפויו של העץ החי ולטיפול הפרופילאקטי בו

(חוב׳ א׳ עמ׳ 70־92)

עד עכשיו לא היה נהוג הטיפול הרפואי באילן היחיד שביער. דרכי־הפעולה המקובלות לשמירת חייהם של עצים בודדים בעלי ערך מיוחד חסרות את הבסיס המדעי. כבר לפני כשלשים שנה ניסה המחבר להרעיל את תפטירי הפטריות הפאראזיטיות שבתוך גזעי העצים. הוא השתמש לכך בתמיסות של מלחי ארסן, אבץ, נחושת וכספית. הוברר, שבקושי רב חודרות תמיסות אלה לתוך חלקו הנגוע של הגזע. לעומת־כן התירכבות של המתכות האלקליות עם חומצות ארסניות או עם חומצה הידרופלואורית, חדירתן לתוך העץ קלה יותר, מפני שהן נבלעות פחות במידיום הקולואידאלי שבעץ, פחות מתירכבות המתכות הדו־ערכיות והתלת־ערכיות (ככל שמועט מטענו החשמלי של היון כן מועט הכוח החשמלי העוצר בו כנגד מגמת ההתפשטות הטבועה בחומר הממוסמס).

המלחים הנ״ל של המתכות האלקליות, שנשפכו אל תוך חורים הקדוחים בגזע, מחלחלים ופושטים בקלות אל תוך העלים, הפירות, אל כל חלקי העץ עד לקצות שרשיו, אבל אין התפשטותם שוה בחלקי הגזע השונים. התמיסות הללו יפות להרעלתם של אילנות, המוקצים לכריתה וניצול טכני. שיטה זו של הרעלת האילן החי להכשירו בכך לצרכים טכניים אחרי כריתתו — קרויה, לפי פאלק, „ההתחדרות החיונית״ (אימפרגנציה אוטוויטאלית). אולם אף התמיסות האלה אין בהן כדי לשמש אמצעי־בעור תקיף כנגד הפטריות הפאראזיטריות, שנטפלו לחלקי עץ מסוימים. התפוצה בעץ מפזרת ומחלישה את פעולתן.

יש לשער, שהפעולות השונות, שהנוזל האחד פועל על הצמחים השונים, יסודן בהבדלים שבמבנה הדופן של תאי־המשמר. יש ידים להנחה, שמערכתם ויחסם הכמותי של חמרים חימיים שונים, כגון הקוטין, התאית וכו׳, מחייבים הפרשים בדרגת התפיחה, ואלה האחרונים הם הגורמים לפתיחת הפיוניות במקרה האחד ולסגירתן במקרה האחר. ולא עוד אלא שאפשרי הדבר, שההשפעות הללו אינן נטולות ערך אף לגבי תנועות הפיוניות המתחוללות בצמח החי.

ה. ר. אופנהיימר

הערות בקרתיות על ערכה של שיטת לויד — שיטת הפיקסציה של הפיוניות ע״י כוהל

(חוב׳ א׳ עמ׳ 43־47)

שיטת לויד, המשמשת למדידת פתיחתן של הפיוניות, מתבססת על ההנחה, שדפנות התא החי הנטבלות בכוהל טבילה רהוטה, איבוד מימיהן המהיר גורם להן שניטלת גמישותן והן נשארות קבועות ועומדות בצורה שהיתה להן לפני רגע הטבילה. עיון בדברי לויד גופו מראה, שאף הוא עצמו גילה מקרים, שהפיוניות שינו בהם את מידת פתיחתן לאחר שהועברו ממים לכוהל. ולא עוד אלא שהוא מתאר פיוניות של Agave, שגם לאחר „פיקסציה" בכוהל באה תמורה בפתיחתן משהועבר האפידרמיס למים. מכאן, שההנחה היסודית של לויד (שניטל מהדפנות כשרונן לתפוח ולהתכווץ בנוזלים) אינה נכונה.

הנסיונות של מ. נאדל, שנתפרסמו בכת״ע זה, מגבירים את הספקות. אמנם ההיסטולוגיה מכירה פיקסציה של הפלסמה, אבל פיקסציה של דפנות־התא — זו, כנראה, אינה בנמצא. עדיין לא הוברר טעמו של הדבר, שיש דפנות המתמתחות מיתוח ניכר ויש שאינן מתמתחות. לויד לא הוכיח, שפיוניות הצמחים, שנבדקו על ידו, שמרו בכוהל על צורתן שהיתה להן קודם באויר; הוא לא השווה אלא את המצבים שבמים ובכוהל. מדידות, שנעשו ע״י חוקרים אחרים, הראו במקרים מרובים הבדלים גדולים בין רוחב הפתיחה שבאויר ובכוהל.

א. הראובני

הכשות הגסה

(חוב׳ א׳ עמ׳ 48־50)

הכשות הגסה מצויה לא רק בגליל ובעמק־יזרעאל, אלא גם בסביבות ירושלים, באזורה של יפו, בעמק־הירדן ועל שפת ים־המלח. מרובים ושונים העצים והשיחים הלוקים בה (הרדוף־הנחלים, השזף, סכינוס ועוד). טפיל זה פוגע גם בצמחי התרבות, כגון עצי־הדר וגפנים. היזקו מרובה מכפי האומדנא הרגילה.

של יחסי הצמח למים ובענינים המסתעפים מבעיה חשובה זו, כגון תנועת הפיוניות בעלים, כוח־היניקה של התאים, ההתנדפות, כוח־קיומו של הצמח בעונת היובש.

חקירות גניטיות טפלו בשאלות המוצא והציטולוגיה של תפו״ז יפו. המחקר פנה גם לבעיות היעור ועסק ביערי אלונים ובשאלות על מיני העצים, המתאימים לצרכי יעורם של ההרים וחולות הים.

ענף־מחקר מיוחד, שטופח ע״י ביאליק ז״ל, לייב והראובני, טפל בצמחים שנזכרו בספרותנו העתיקה.

המאמר מסיים ברשימה כללית של הספרות הבוטנית הנידונה (עמ׳ 15־21). הרשימה מביאה 103 עבודות־מחקר.

מ. נאדל

בדבר ההשפעה, שנוזלים שונים, המשמשים כפיקסאטיבים, משפיעים על מצבן של הפיוניות

(חוב׳ א׳ עמ׳ 22־42)

שיטת הפיקסציה של הפיוניות לפי לויד אינה ראויה לשימוש גבי עלי־ההדר. לפיכך חיפשה המחברת אחרי נוזלים אחרים, המסוגלים לשמור על הפיוניות ברקמת האפידרמיס אחר מיתתה ולקיימן במצבן הטבעי, כמות שהוא בחיים. נבחנו: תערובת קארנוא, אציטון, חומצת־חומץ מרוכזת, תמיסה כהלית של יוד, תמיסת פפיפר, פורמלין, פאראפין נוזלי, אתר, נפט ובנזול. הוברר, שאין באלה אף אחד היאה לתכלית הנ״ל.

בצורות שונות מתגלה השפעתם של הנוזלים הנ״ל על הפיוניות: יש שהפיוניות נפתחות על ידיהם ויש שהן נסגרות. קסילול ובנזול גורמים לפתיחתן של הפיוניות בעלי עצי־ההדר.

התצפיות, שנעשו לגבי השפעתם של הנוזלים הנ״ל על צמחים אחרים, גילו אופי מסובך אצל חזיון זה של תנועת הפיוניות לאחר מיתתו של הצמח. לפי נוהג הפיוניות כלפי הנוזלים הנ״ל אפשר להבדיל ביניהן טיפוסים שונים. למשל, הללו של תפוחי־האדמה, השפעת הקסילול עליהן הפוכה מזו שעל פיוניות עצי־ההדר: הראשונות נסגרות מחמת הקסילול.

כיון שאמצתו (טורגור) של התא אין בה לשמש גרם לתנועות המתהוות אחר מיתה, הרי שאת ביאורן יש לבקש בתכונות הפיסיות של דפנות־התאים.

הנסיונות, שנעשו ביחס להשפעתו של האור המקוטב על חתיכות אפידרמיס בעלות פיוניות, הראו, שהשבירה הכפולה של האור משתנית עם העברת האפידרמיס מנוזל לנוזל. ע״י אותה שיטה אופטית הוברר, ששני החמרים העיקריים, שדופן תא־האפידרמיס מורכבת מהם, התאית והקוטין, כושר־תפיחתם אינו שווה.

רשימות לבוטניקה ולמדעי גננות

כרך א׳

סיכומים

העריכה הלשונית ע״י ש. אטינגר, רחובות

ה. ר. אופנהיימר

המחקר הבוטני בארץ־ישראל החדשה

(חוב׳ א׳ עמ׳ 9־21)

עד לתחילת המאה הנוכחית לא התנהל בא״י מחקר שיטתי במדעי־הטבע. הארץ שמשה רק מטרה לתיורים של מלומדים אירופיים ואמריקאיים. הבוטניקן־החוקר הראשון מיושבי הארץ היה אהרן אהרנסון, שנתפרסם כמגלה של אם־החטה. הוא יסד את תחנת־הנסיון החקלאית הראשונה בעטלית. אחרי אהרנסון, שמצא את מותו הטרגי בתאונת אוירון ב־1919, ייסדו א. ווארבורג וי. אלעזרי־וולקני את המכון לחקלאות ומדעי־הטבע. ממוסד זה, שעיקרו היתה תחנת הנסיון החקלאית בתל־אביב (עתה ברחובות), התפתחו וצמחו מוסדות־מחקר שונים: המחלקה הבוטנית של האוניברסיטה העברית בירושלים, המחלקה לפיטופתולוגיה והמחלקה לפיסיולוגיה וגניטיקה של מטעים, שתיהן בתה״נ שברחובות. חוץ ממקומות־מחקר אלה קיימים בארץ המעשב של המושבה האמריקאית בירושלים, המעשב של אהרונסון בזכרון־יעקב, המעבדות הבלתי־תלויות לביולוגיה בת״א, המוזיאון לבוטניקה של התנ״ך והתלמוד שע״י האוניברסיטה העברית והגן הבוטני שע״י בית־הספר החקלאי במקוה־ישראל.

המאמר סוקר שורה ארוכה של עבודות־מחקר, שנעשו בידי חוקרים ארץ־ישראליים או שהוקדשו לנושאים מן הצומח הארץ־ישראלי. הסקירה מקיפה את שלשים השנים האחרונות. במקצועות של הסיסטמטיקה והגיאוגרפיה של הצמחים נמנים מחקריהם של אהרנסון, אייג, אופנהיימר, ווארבורג וזהרי. אייג, זהרי ופיינברון פרסמו את המגדיר לצמחי א״י. דינסמור הוציא במהדורה שניה את הפלורה הידועה של ג. פוסט.

החקירות של רייכרט ושל חבריו לעבודה פרלברגר, ליטואר והילינגר הניחו יסוד להכרתם של מחוסרי־הפרחים. נחקרו בעיקר פטריות המחליאות צמחי־תרבות, כגון את הבננות, את עצי־ההדר, החטה, השעועית. תשומת־לב יתרה נתייחדה לחקירתן של הפטריות ממשפחת החלדוניים, המנגעות את החלבלביים. גב׳ רבינוביץ־סרני פרסמה רשימה של טחבים ארץ־ישראליים.

בענף הפיסיולוגי של הבוטניקה התחיל המחקר בשנת 1926. העבודות, שפורסמו ע״י י. ד. אופנהיים, ה. ר. אופנהיימר ואחרים, עוסקות עיקרן בבעיה

רשימות לבוטניקה ולמדעי גננות

כרך א'

רחובות [א"י]
תרצ"ו – תרצ"ז

דפוס מ. שהם, דרך תל־אביב